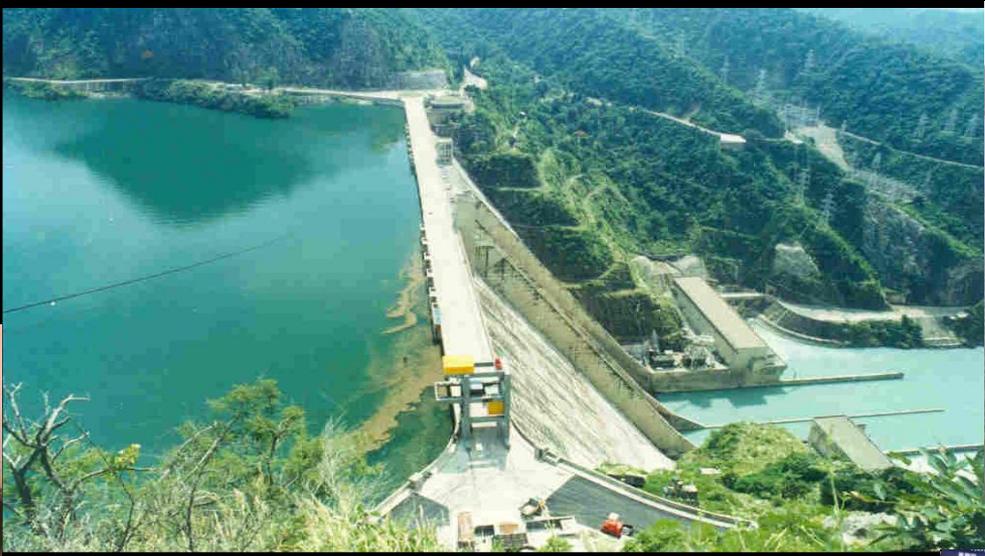




National Hydrology Project: Integrated Water Resources Management



May 2016

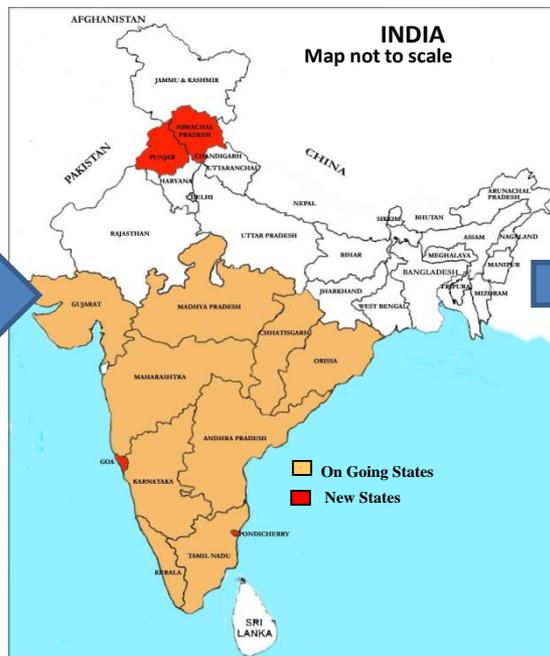
RELIABLE, TIMELY, QUALITY, CONSISTENT, PUBLIC DATA
(www.indiawrm.org)

HP-I (1995-2003)



- 9 States; 6 Central Agencies
- Manual Data Collection
- Desktop data management
- Data collection & management

HP-II (2006-2014)



- 13 States; 8 Central Agencies
- Real Time Data Acquisition
- Web-based data management
- Data Collection, management & analysis (pilot basis)

NHP



- Pan-India; 10 Central Agencies
- Standardization of RTDAS as national level
- Web-based National Database – IndiaWRIS
- Institutionalization of data collection, management and analysis/ modelling at Pan-India scale



Concepts of National Hydrology Project



- **Standardizing Water Resources data and Information System for the country with uniform procedures and database.**
- **Integration of River basin information with improved access to Centre, States and Public-domain.**
- **Introducing country wide generic solutions for flood forecasting and River basin based water management.**
- **Developing site specific solutions for water resources planning, operation and management including use of remote sensing based techniques.**



NHP: Project Details



Project Development Objective:

To improve the extent, reliability and accessibility of water resources information and to strengthen the capacity of water resources management institutions in India.

Project Components:

Component	Project Cost	Financing Share	
		GOI	World Bank
A: Water Resources Data Acquisition System	147	73	73
B: Water Resources Information Systems	48	24	24
C: Water Resources Operations and Planning System	56	28	28
D: Institutional Capacity Enhancement	83	41	41
Contingency	16	8	8
Totals	350	175	175

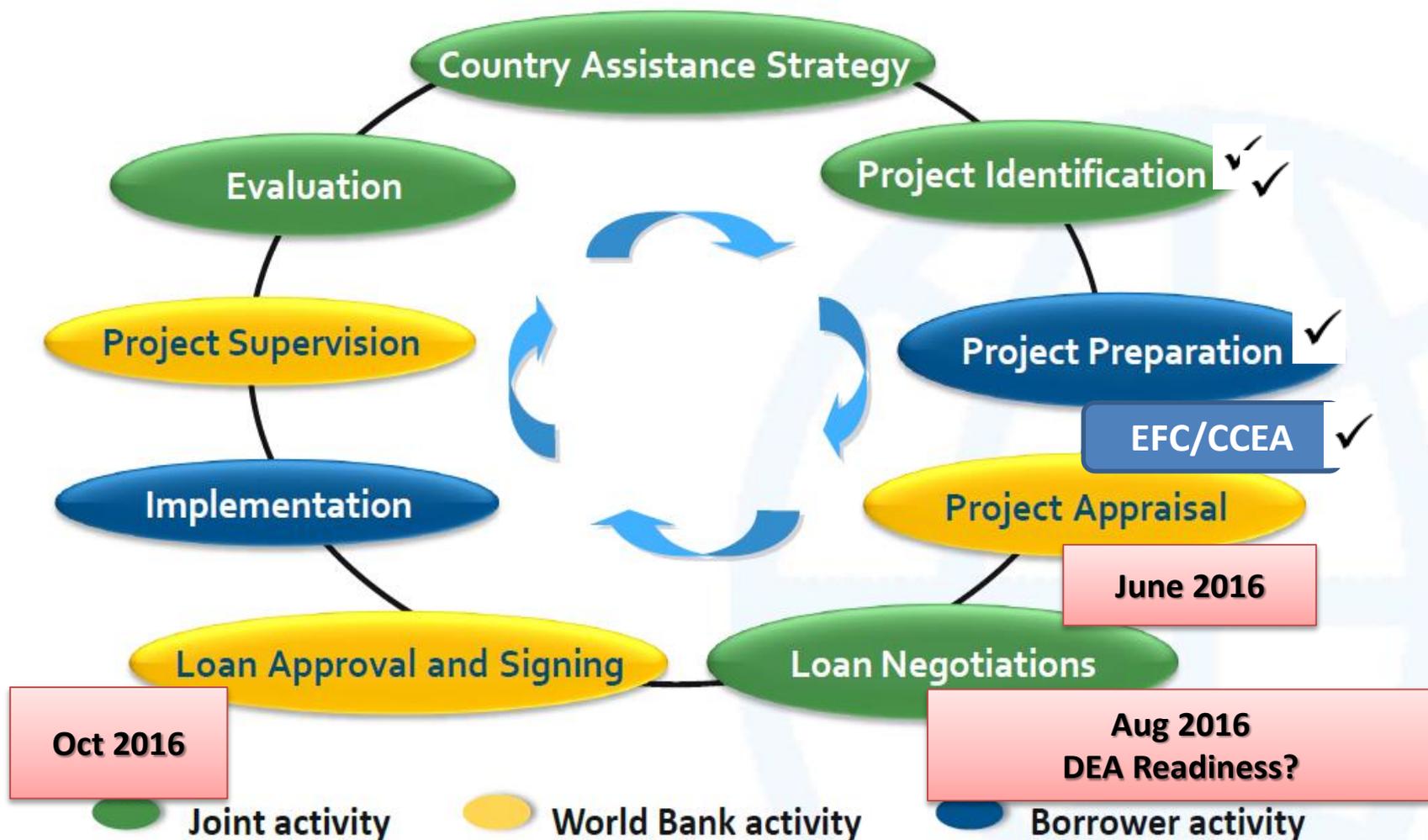
Cabinet Clearance: INR 3640 (Cabinet clearance), two stages

World Bank Phase 1= USD 350 M (2275 crore), Duration = 8 years

(World bank will be 8 years from start, therefore it is equivalent to Stage 1+50% of Stage 2)

Negotiation: September 2016

Effectiveness: Feb 2016 ?





Project Timeline

S. No.	Activity	Agency	Due by	Status
1	Finalize detailed PIP	IAs	Sep 30, 2015	
2	Finalization of PIP by MoWR	MoWR	Nov 15, 2015	
3	Submission for EFC clearance	MoWR	Sep 2015	Done
4	EFC/CCEA Clearance	MoWR	Oct 2015/Apr 2016	Done
5	Project Appraisal	WB	June 2016	
6	Negotiation	WB/ MoWR	Aug 2016	It will depend on DEA Readiness.
7	WB Board for clearance	WB	Sep 2016	
8	Legal opinion	MoWR	Oct 2016	
9	Effectiveness		Oct , 2016	



DEA Readiness

- 1. Project management units (PMU) at each agency should be strengthened in line with project requirements.**
- 2. Thirty percent (>600 crore) of procurement should be ready to be awarded.**
- 3. Major consultancies (>INR 200 crore) for the first two years of the Project should be awarded prior to effectiveness.**

It would require at least 5 months to reach the readiness...target.

Agencies	HP2	New	Total	Institution Readiness
States	19	17	36	30
UT	1		1	1
Central agencies	5	3	8	1
RBO	1	1	2	2
Total	27	20	47	34

SPMU in 6 state agencies are yet to be strengthened: Haryana, Bihar GW, Orissa SW/GW, Uttarakhand; Tripura not active.

Central agencies are responding to the critical needs but no dedicated team to guide the states and prepare. Sol has not indicated any active interest, so back up arrangements need to be made.



DEA Readiness: Criteria 2 (Bid Document)



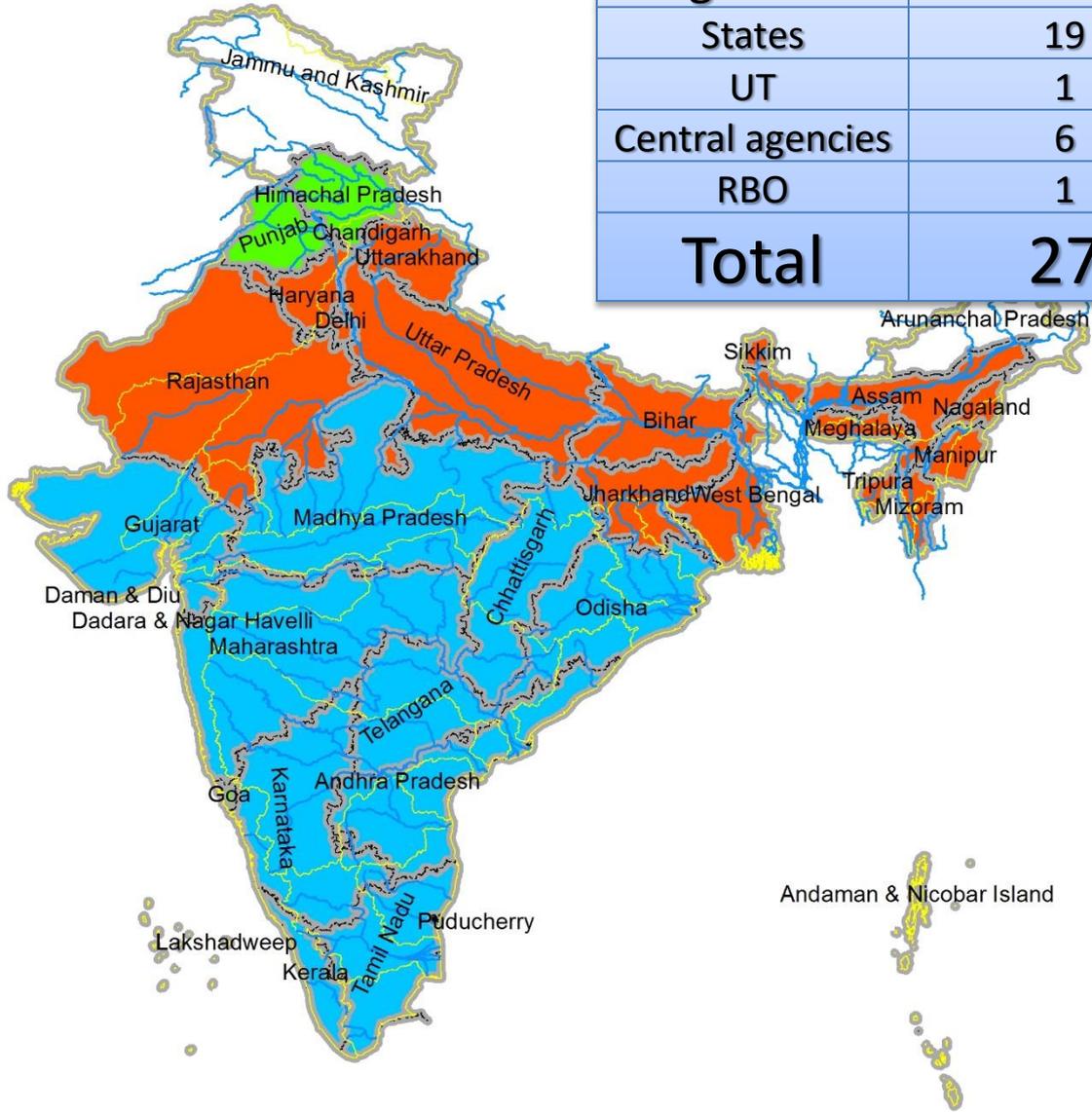
Agency	Type	Value of procurement (Crore)	Status/ Time required	Time in Hand
MoWR/ CWC	Framework agreement of Hydromet	300	Specifications are ready	2 month
States	Hydromet and SCADA	25	Bids are prepared in progress	2 months
All IAs	Data centers (renovation & new Construction)	15	No substantial progress	2 months
All IAs	IT equipment, Office furnishing, Vehicles etc. (through DGS&G)	10	No substantial progress	2 months
Total		350 (??)		

DEA Readiness: Criteria 3 (Consultancies)



Agency	Type	Value of procurement (Crore)	Status/ Time required	Time In Hand
MoWR	TAMC	100	EOI to be published soon	3 month
CWC	River basin FF and River assessment	140	TOR finalized	3 month
States	Studies	10	??	3 months
Total		250		

Implementing Agencies	HP2	New	Total
States	19	17	36
UT	1	1	2
Central agencies	6	2	8
RBO	1	1	2
Total	27	21	48



Legend

-  Rivers
-  River Basins
-  State Boundaries
- HPStatus**
-  HP-I
-  HP-II
-  New States



Central Agencies :

1. Ministry of Water Resources, River Development and Ganga Rejuvenation (MoWR, RD & GR)
2. Central Water Commission (CWC)
3. Central Ground Water Board (CGWB)
4. Central Water and Power Research Station (CWPRS)
5. National Institute of Hydrology (NIH)
6. Central Pollution Control Board (CPCB)
7. Survey of India (SOI)
8. National Remote Sensing Agency (NRSA)

River Basin Agencies

1. Damodar Valley Corporation (DVC)
2. Bhakra-Beas Management Board (BBMB)

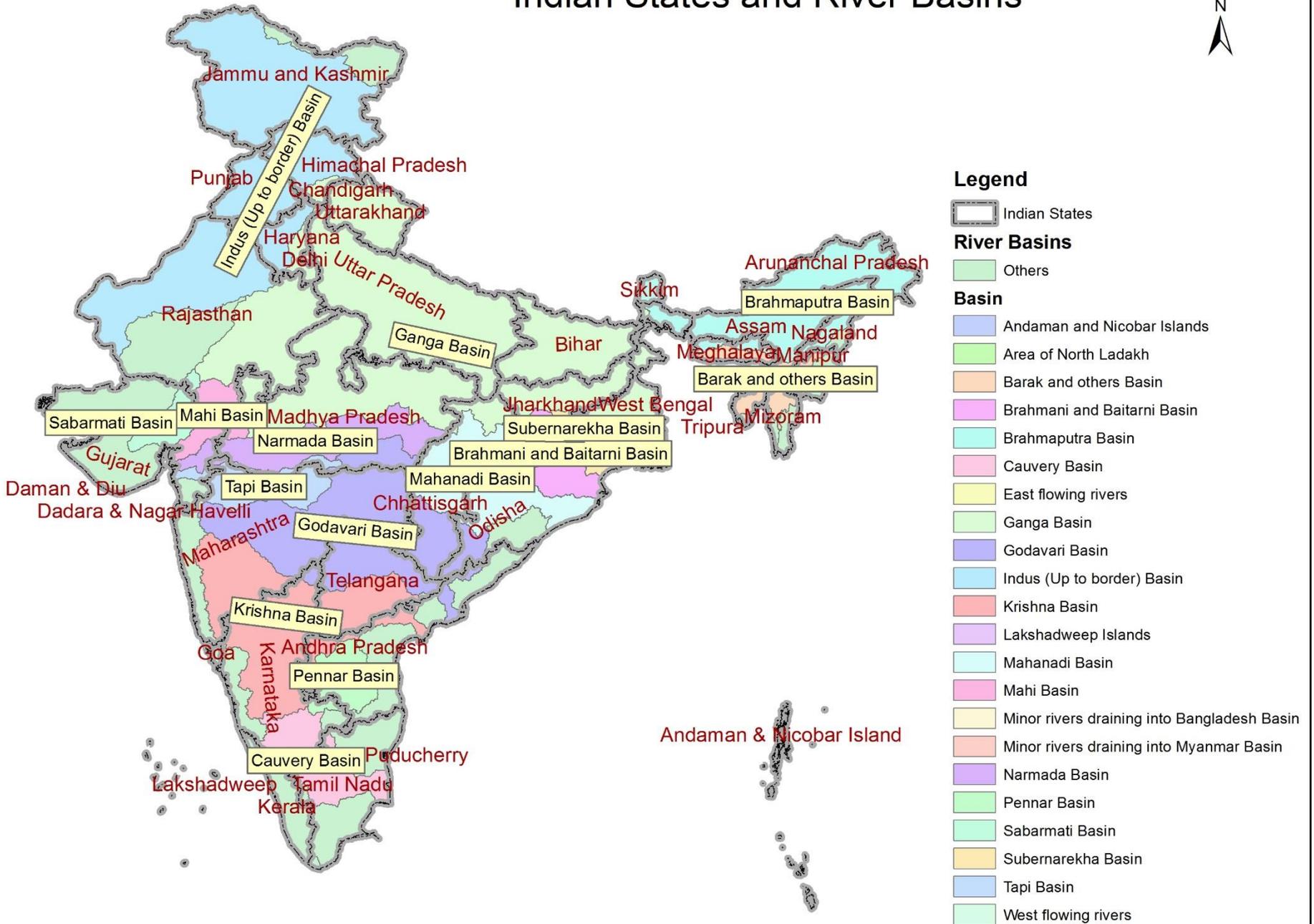
States/UTs (Old):

1. Andhra Pradesh
2. Chhattisgarh
3. Himachal Pradesh
4. Goa
5. Gujarat
6. Madhya Pradesh
7. Maharashtra
8. Karnataka
9. Kerala
10. Odisha
11. Puducherry
12. Punjab
13. Tamil Nadu

States/UTs (New):

1. Assam
2. Bihar
- 3. Delhi**
4. Haryana
5. Jharkhand
6. Manipur
7. Meghalaya
8. Mizoram
9. Nagaland
10. Rajasthan
11. Sikkim
12. Telangana
- 13. Tripura**
14. Uttar Pradesh
15. Uttarakhand
16. West Bengal

Indian States and River Basins



Better Basin Planning and Operational Decisions in Water Management

D. Institutional Capacity Enhancement



Centre of Excellence

Collaboration with National/International Institutes



Capacity Building



Outreach and Awareness

B: Water Resources Information System

GIS Layers

High Resolution DEM

Weather Forecast

Generic Hydrological Products

Remote Sense Imageries

India-WRIS WebGIS
Water Resources Information System of India

States-WRIS

Maharashtra

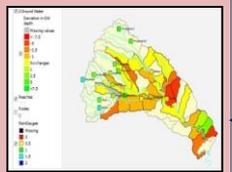
Karnataka

AP

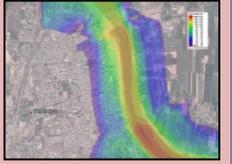
Telangana

Krishna Basin WRIS

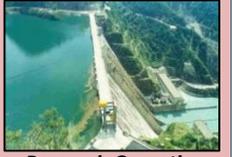
C: Water Resources Operation and Planning



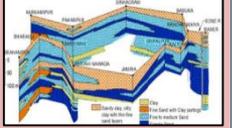
River Basin Planning



Flood management



Reservoir Operation



Groundwater Assessment



Irrigation management

A: Water Resources Data Acquisition System

Meteorological Monitoring

River/Reservoir Monitoring

Groundwater Monitoring

Water Quality Monitoring

SCADA for canal/reservoir

Community monitoring/crowd sourcing

State Data Centers



Coordination

Component	Main Function	Responsible Institution
A1	Design of hydromet and procurement	CWC, CGWB, CPCB
A2	HIF for Testing of Hydromet	CWPRS
B1	Standard database management systems	CWC, CGWB, CWPRS
B2	NWRIS standards and protocols	NWIC, CWC
B2	Data sharing protocols and monitoring	NPMU
C1,2	Flood forecasting and river basin assessment models	CWC
C1,2	River basin modeling training and expert support	NIH
C3	Scope of PDS and technical support	NIH
D1	Collaborations with International organizations	NPMU
D2	National and international trainings	NIH
D3	Overall project management, M&E and FM	NPMU



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Centralized Support



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Agency	A: Hydromet	B: WRIS	C: WR tools	D: Capacity Building
MoWR	<ul style="list-style-type: none"> -Provide Hydromet Experts in regional office 	<ul style="list-style-type: none"> - Strengthen NWRIC - Data integration protocol. - MoUs for data/information integration among agencies 		<ul style="list-style-type: none"> - Procure TMC. - Plan center of excellence - Collaborations with National and International Institutes.
CWC	<ul style="list-style-type: none"> - Framework Agreement - Telemetry INSAT, VSAT, GSM - Real time DAS arrangements 	<ul style="list-style-type: none"> - Upgrade E-SWIS for RTDAS and - Prepare standard protocols for India WRIS for states. 	Consultancy for Regional flood and Water Res models.	Establish regional FF and River Basin centers with States.
NIH	Training program in Hydromet	Training in web-based data display, survey , RS	<ul style="list-style-type: none"> - Coordinate PDS activities. - Provide WR modelers to each agency 	<ul style="list-style-type: none"> -Center of Excellence for trainings - Online and classroom Training development.



Centralized Support



Agency	A: Hydromet	B: WRIS	C: WR tools	D: Capacity Building
CGWB	Guide in GW monitoring design and aquifer parameters.	Centralized GW database management (E-GEMS)	Guide in Aquifer mapping and other GW related studies.	GW modelling center.
NRSC		Remote sensing based applications	RS based WR applications for River basin and irrigation assessment.	Training in RS based applications
Sol		Coordinate Survey, and provide high resolution DEM		
CPCB	WQ standards, WQ lab specifications	Centralized Database Management (EWQIS)	Studies on Water quality issues	
CWPRS	R&D for Hydromet and SCADA			



A: Water Resources Data System

A1. Water Data Acquisition system



A2. National and State Water Data Centers





A1. Hydromet Observation

Proposed Hydro-met

Type of Station		Number
Automatic Rain gauges		2452
Automatic Weather Stations		559
Surface Water Level Monitoring	Rivers	943
	Dams / Barrages	550
	Canals	423
	Total	1916
Ground Water Level Monitoring		5744
Water Quality Sampling Sites		1781

Hydromet Observation Proposed

Agency	Rain Guage	Automatic Weather Stations	Water Level Monitoring				Ground Water Levels	Water Quality
			Rivers	Dams / Barrages	Canals	Total		
Andhra Pradesh	45	4	72	0	0	72	925	925
Assam	150	10	100			100	45	83
BBMB			20	20	50	90		10
Bihar	67	5	52	7		59		
CGWB						0		60
CWC	140	30	100			100		25
Chattishgarh	108	5	34	20	0	54	506	0
Goa		5	4			4	50	
Gujarat	200	150	48	152		200	162	
Haryana	120	15	4	9	100	113	800	10
Karnataka	500	40	23	10	10	43	0	2
Madhya Pradesh	322	14	20	74	40	134	450	0
Maharashtra	85	16	44	65	168	277	0	5
Manipur	5	6	5	6	0	11	0	6
Meghalaya	30	5	27	0	0	27	25	1
Mizoram	32	12	13			13	10	
Nagaland	5	13	32			32		
Odisha	200	15		30		30	600	
Puducherry	10	0	7	0	0	7	5	2
Punjab	0	1	15	1	1	17	600	1
Rajasthan	143	73	30	40	25	95	150	154
Sikkim	31	31	40	42	0	82	0	4
Tamil Nadu	76	56	90	0	0	90	766	4
Telangana	50	9	46	50	25	121	450	455
Uttarkhand	36	20	34	6	4	44	0	34
West Bengal	97	24	83	18		101	200	

<http://www.indiawrm.org/hydro.aspx>



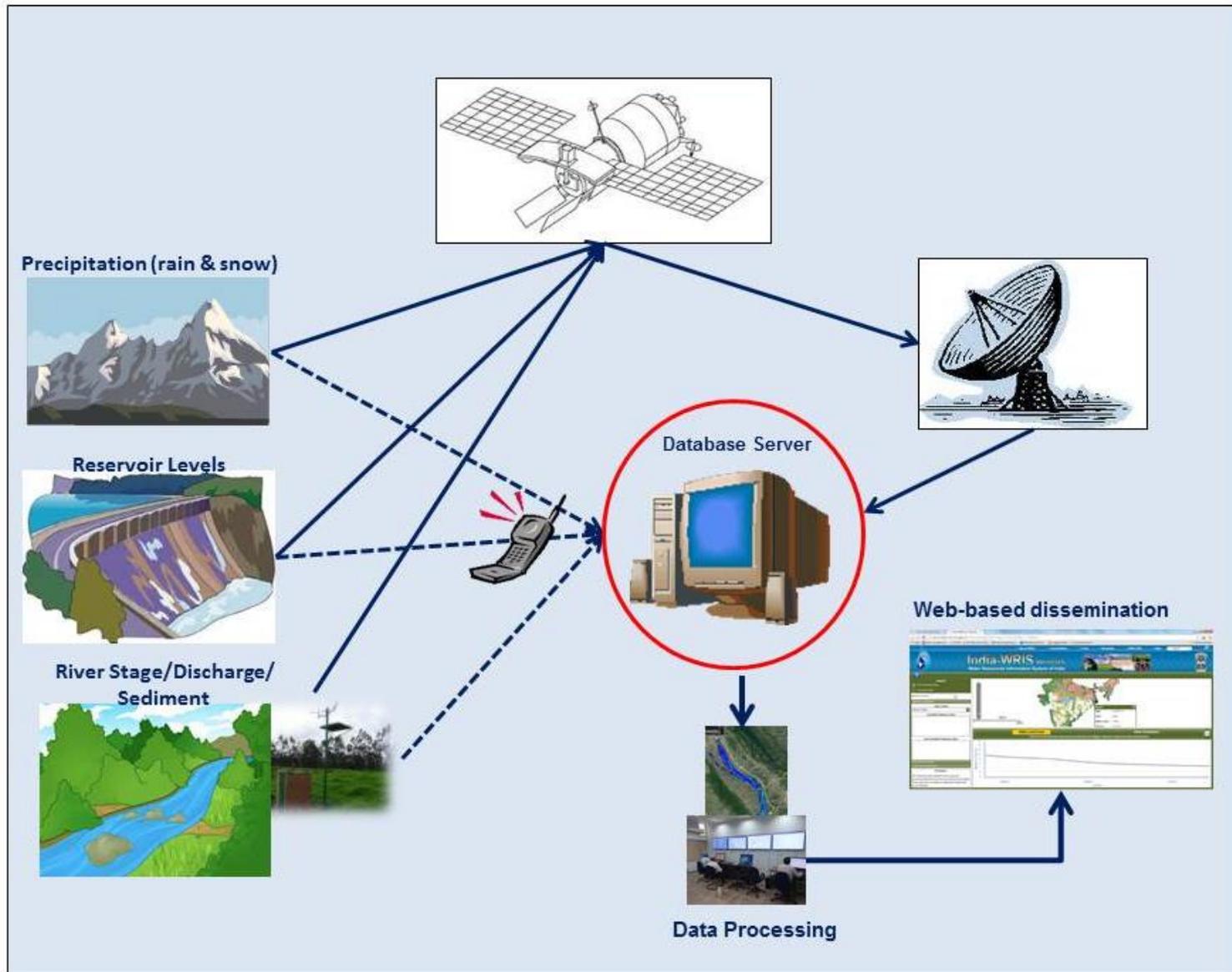
The screenshot displays the web application interface for the India Water Resources Management (IWRM) Hydrology Data System. The main map shows the geographical distribution of weather stations across India, with a detailed view of a station in Raipur Maidan, Himachal Pradesh. The station details include:

- Station Name: Raipur Maidan
- State: Himachal Pradesh
- Implementing Agency: BBMB
- Latitude: 31.333056
- Longitude: 76.391389

The interface also shows a legend for Automatic Weather Stations (red pin) and Manual Weather Stations (blue pin), and a list of suggested sites on the left side.

Please update your baseline of existing Hydromet

A1. Hydromet Observation



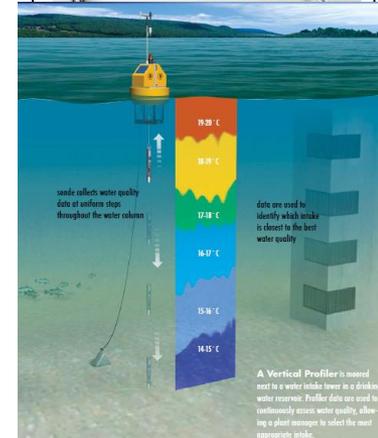
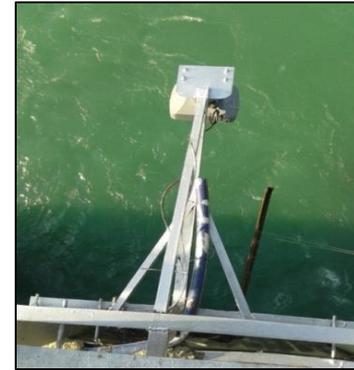


A: Water Resources Data System



A1. Water data acquisition system

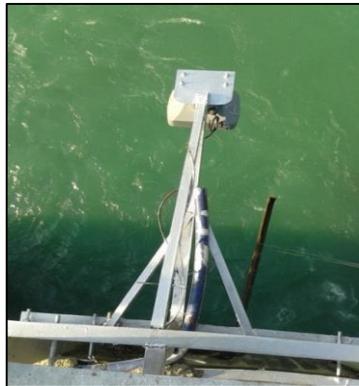
- **Weather:** automatic weather stations, rainfall and snow gauges
- **Rivers:** stage/discharge of rivers, water quality
- **Groundwater:** levels, water quality
- **Reservoirs/tanks: Integrated reservoir monitoring and (Storage water levels, gate positions, outflows and spillways), SCADA and dam safety**
- **Sediment:** bed load & suspended load monitoring
- **Coastal monitoring**
- **Diversions, water use and irrigation monitoring**



Automatic Weather Stations



Water Level Recorder



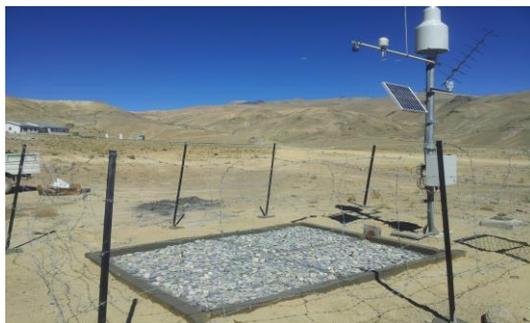
Water Quality Station



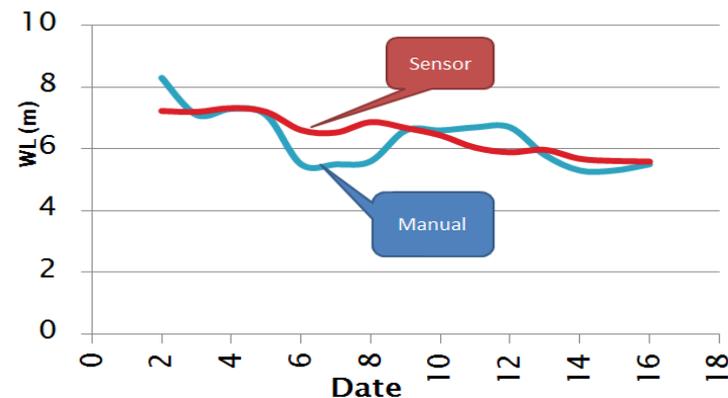
Digital GW Recorder



Snow Pillows



River Flow



During HP2: Six states have implemented the system

- Reliable and timely data in several states of India
- Saving in operating cost by 50% of manual cost.



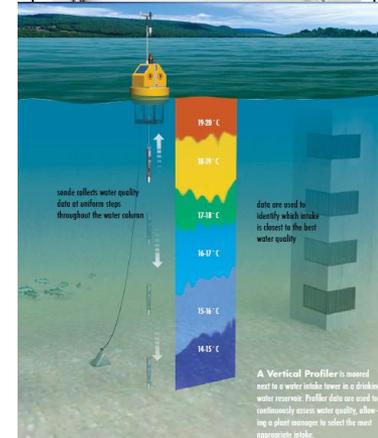
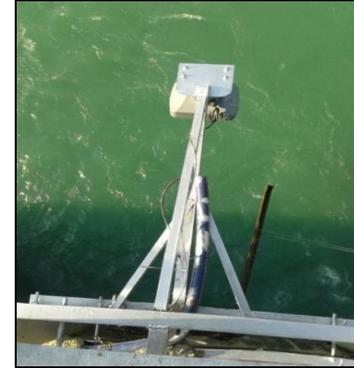
A: Water data acquisition System



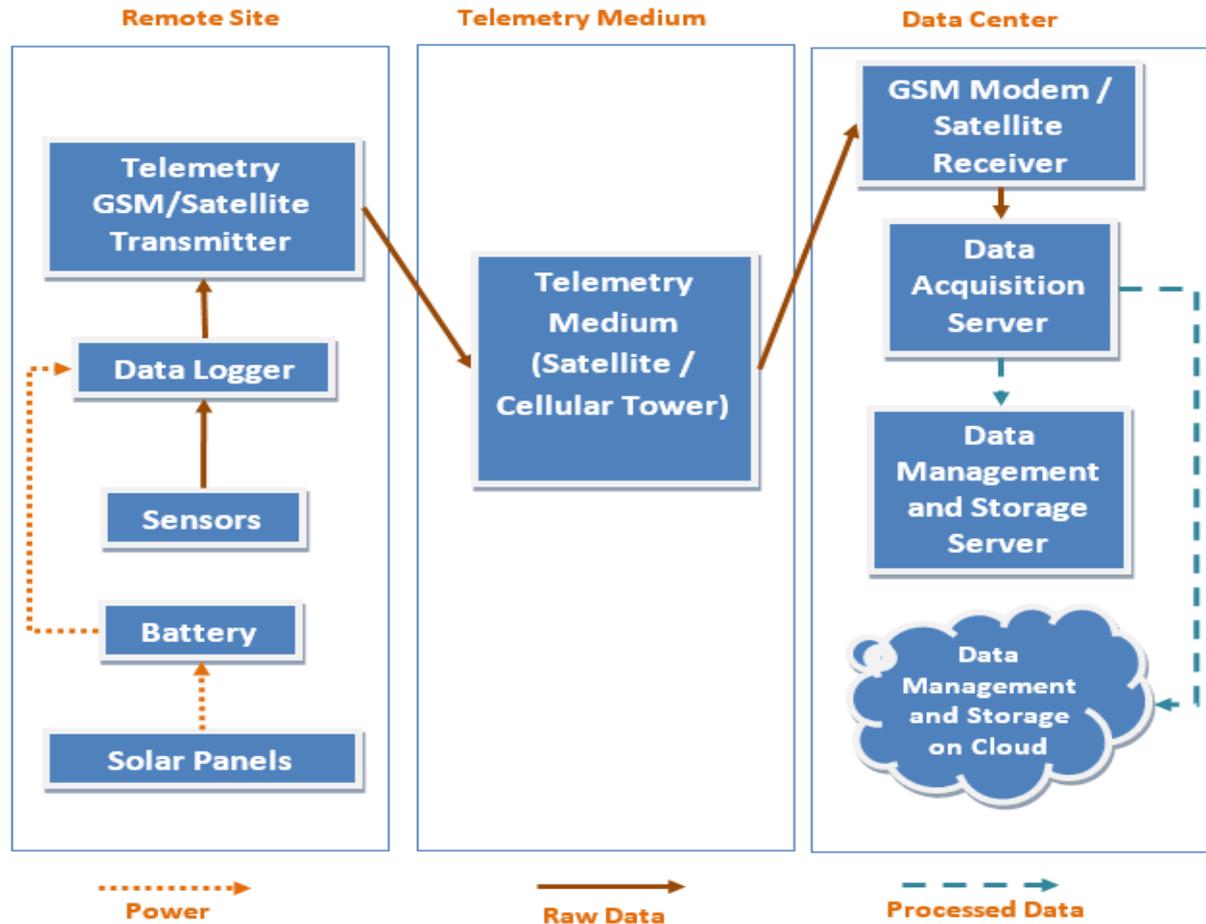
A1. Water data

How to make data reliable?

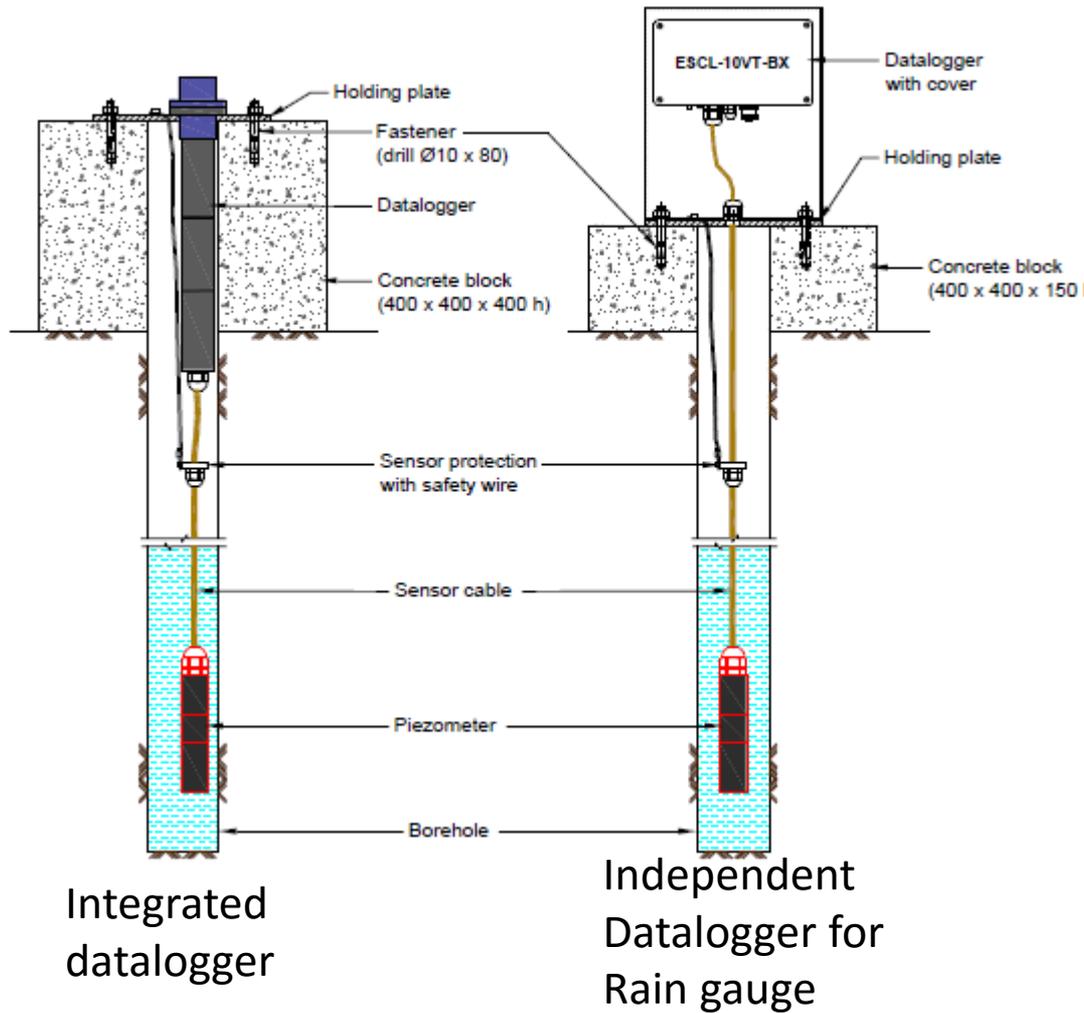
1. Automated (datalogger with sensor)
2. Real time with telemetry
3. Mobile based with GPS/time stamped (for instance photo of gauge with location and time stamp)



A typical RTDAS system



DWLR with and without rain gauge



Source: West Bengal SWID

Source: Gujaral et al, however not recommending any make/model

GW cluster monitoring in different aquifers

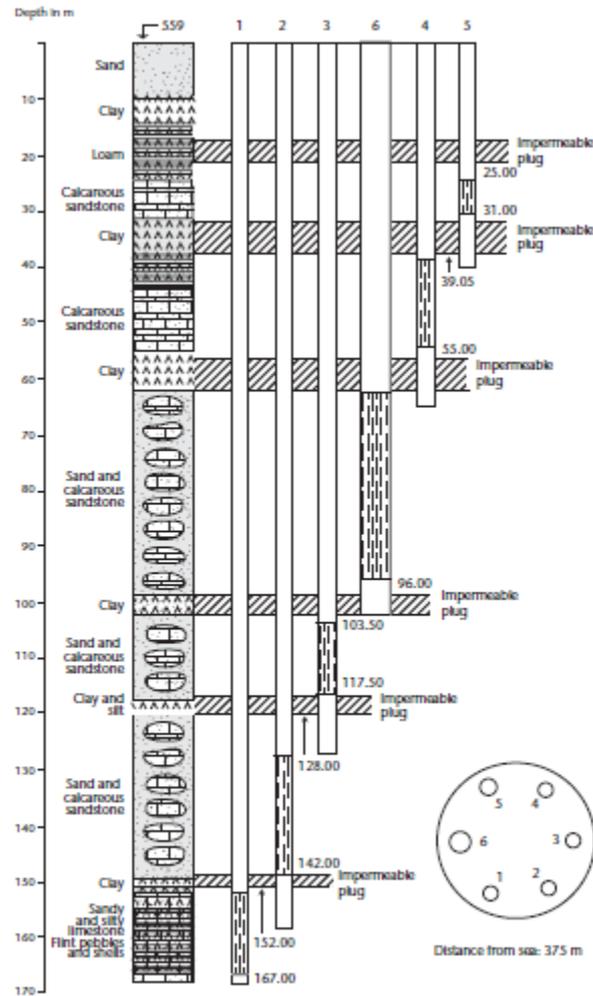
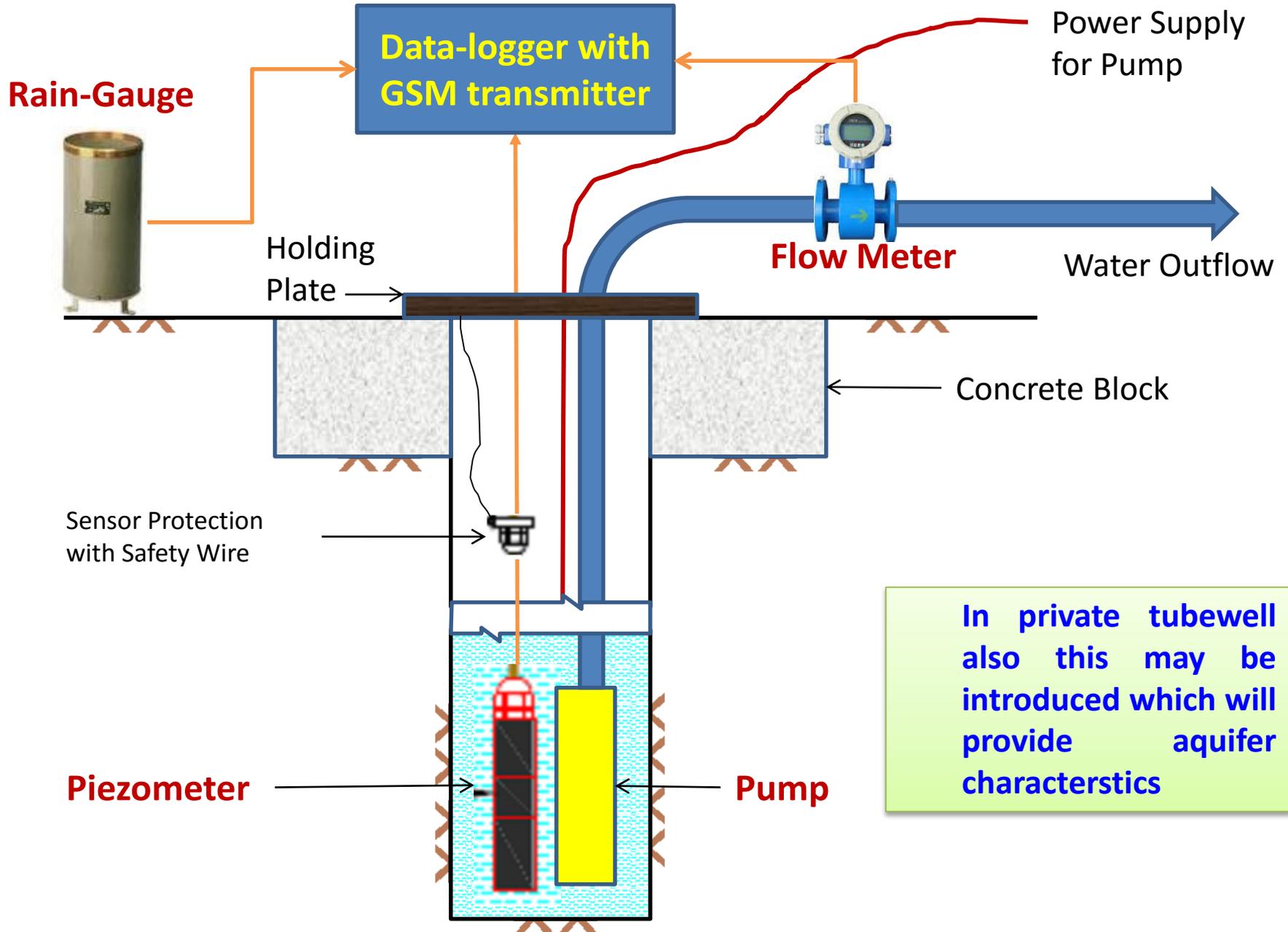
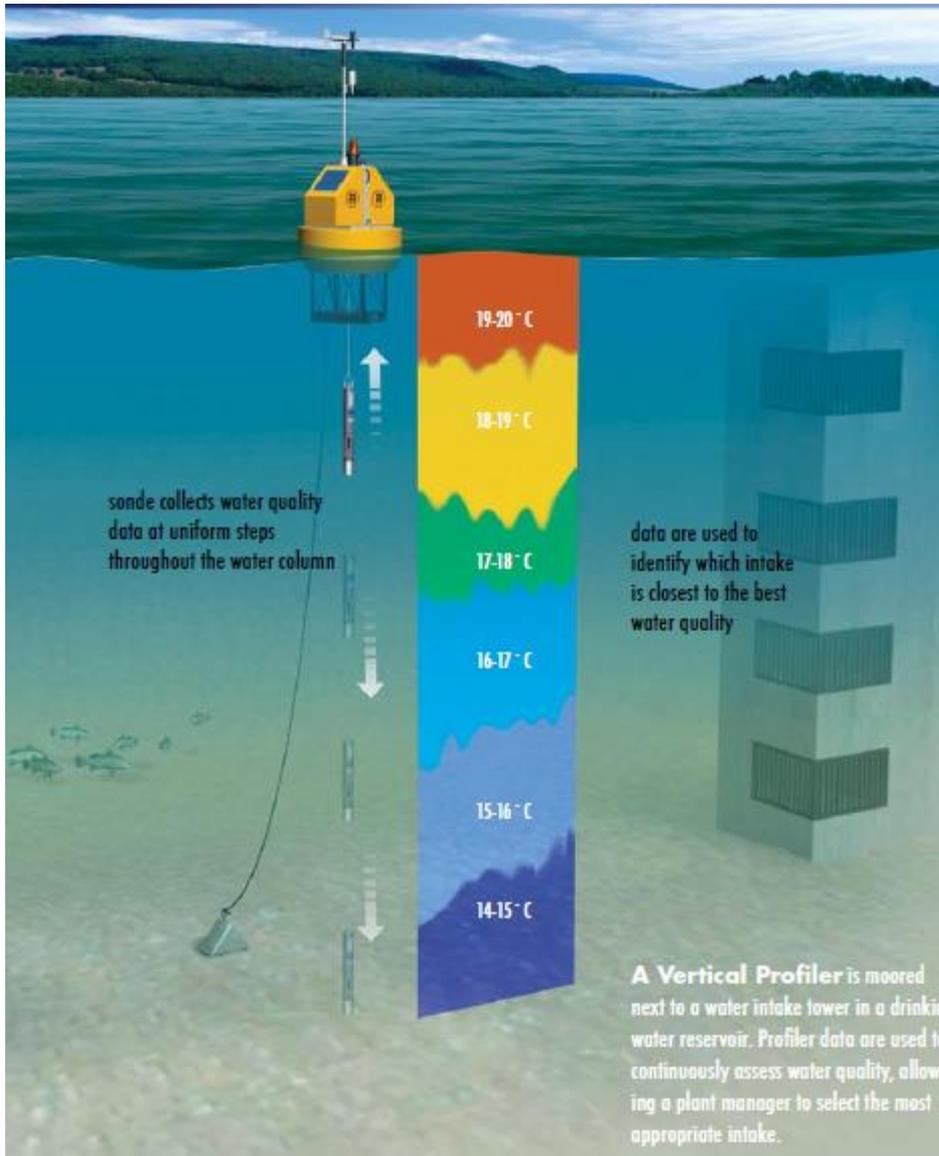


Figure I.6.4. Schematic vertical cross-section of an observation well in a multiple aquifer system

A1.1 Integrated GW monitoring system



A1. Portable Water quality Sondes



Sondes: EXO1 EXO2



A1.2 Integrated reservoir monitoring system

Automated Weather Station

Control room with solar power and datalogger and transmission system



Reservoir water level recorder

Outflow in canal and spillway:
Water level by Radar and discharge measurement by ADCP





A1.2. Reservoir monitoring and SCADA system



Reservoir monitoring and automated Operation of gate system for Reservoir/Barrages

- UP
- West Bengal
- MP
- Haryana

Canal Gate control system for major canal

MP, Rajasthan

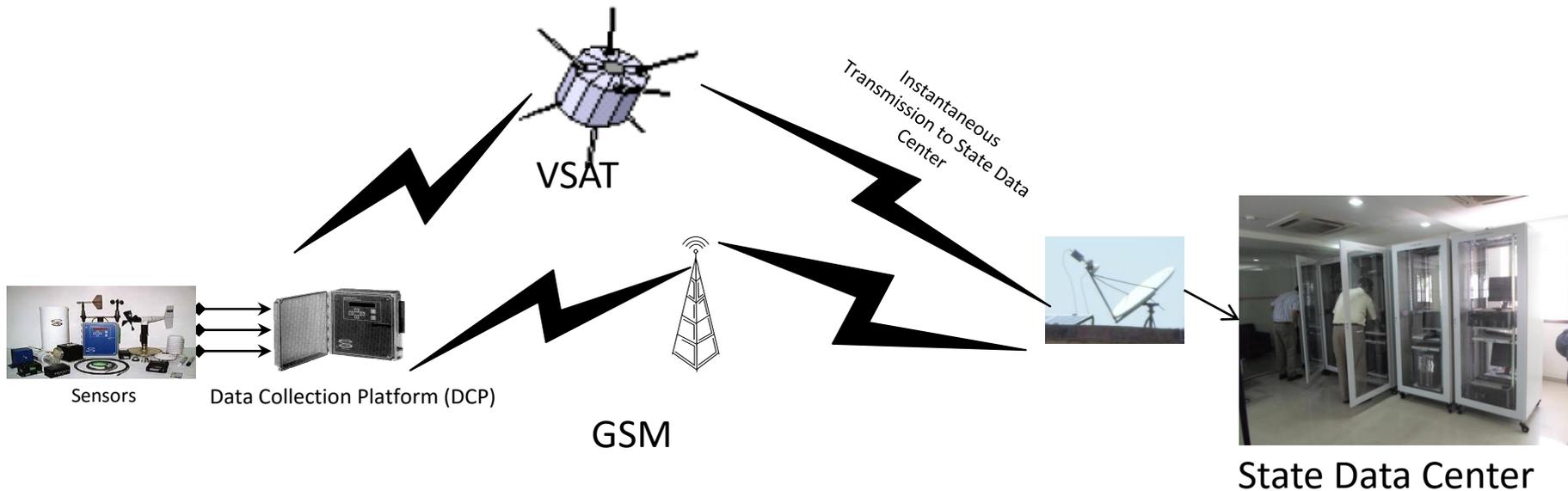


How many bids can be ready by Negotitation?

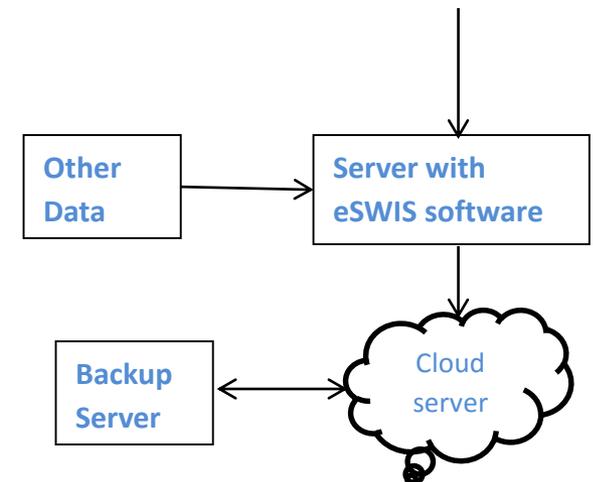
Display System on Site

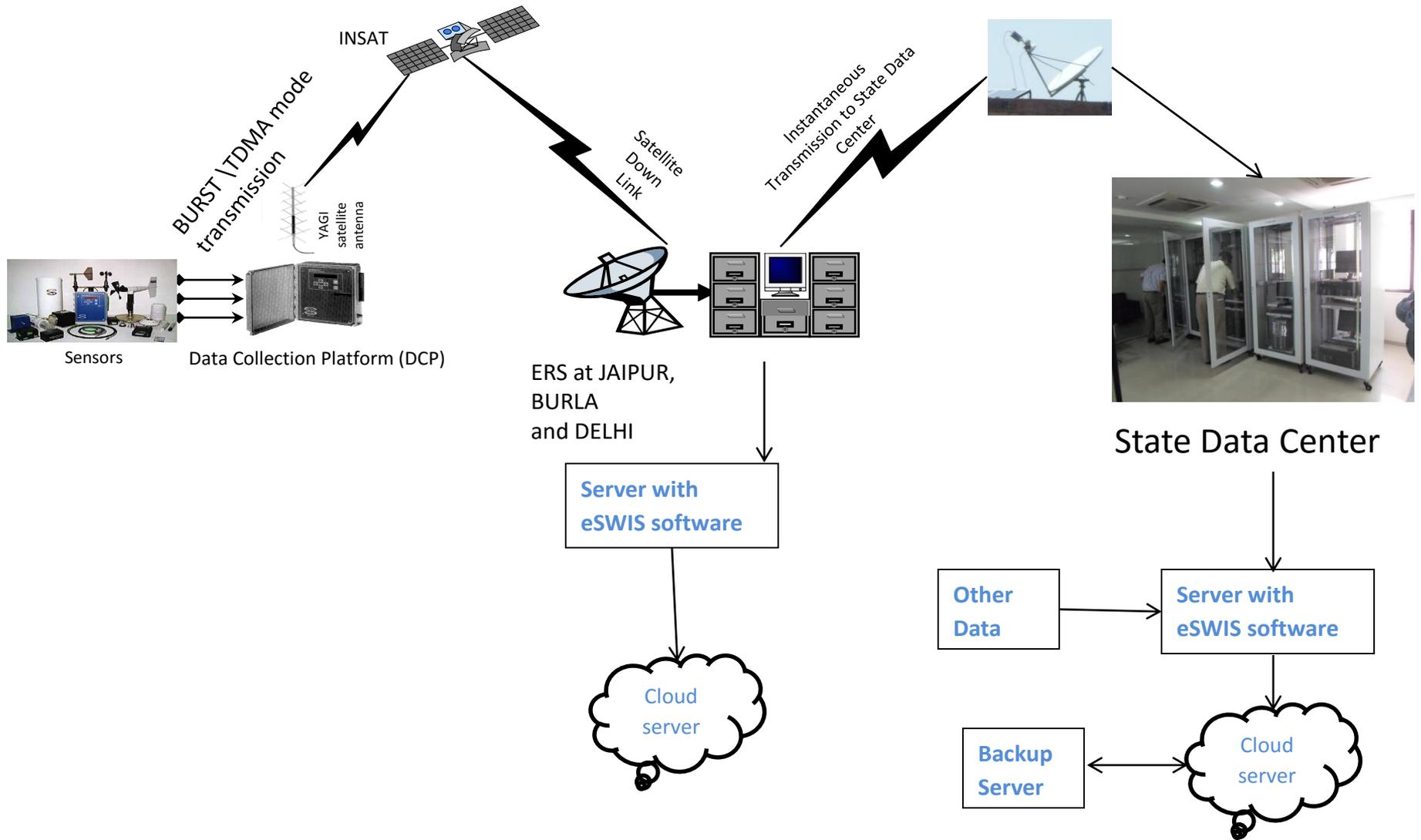
- Enable Site Engineer to better connect with Data
- Provide efficient feedback about accuracy of measured data
- For Communities – Running text on screen provide real time information in local language
 - May provide flood/Rainfall forecast, Wind information etc.

Servers – Maximize use of Cloud Servers

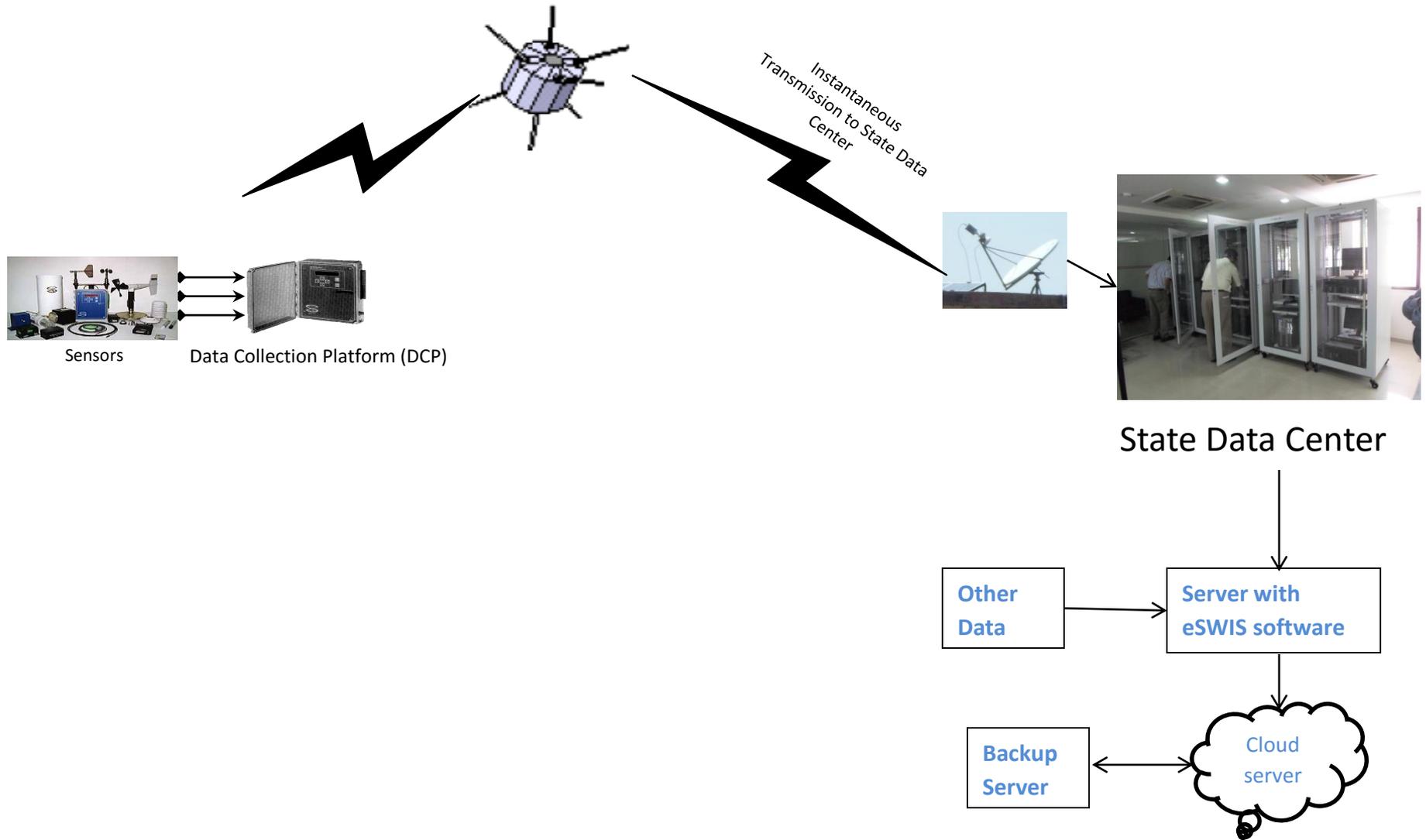


- Maintaining the servers a challenge for State agencies
- Can avoid full time IT staff by using cloud servers
- Backup system to safeguard against crashing of servers
- No requirement for having sophisticated security and firewall systems in state data centers

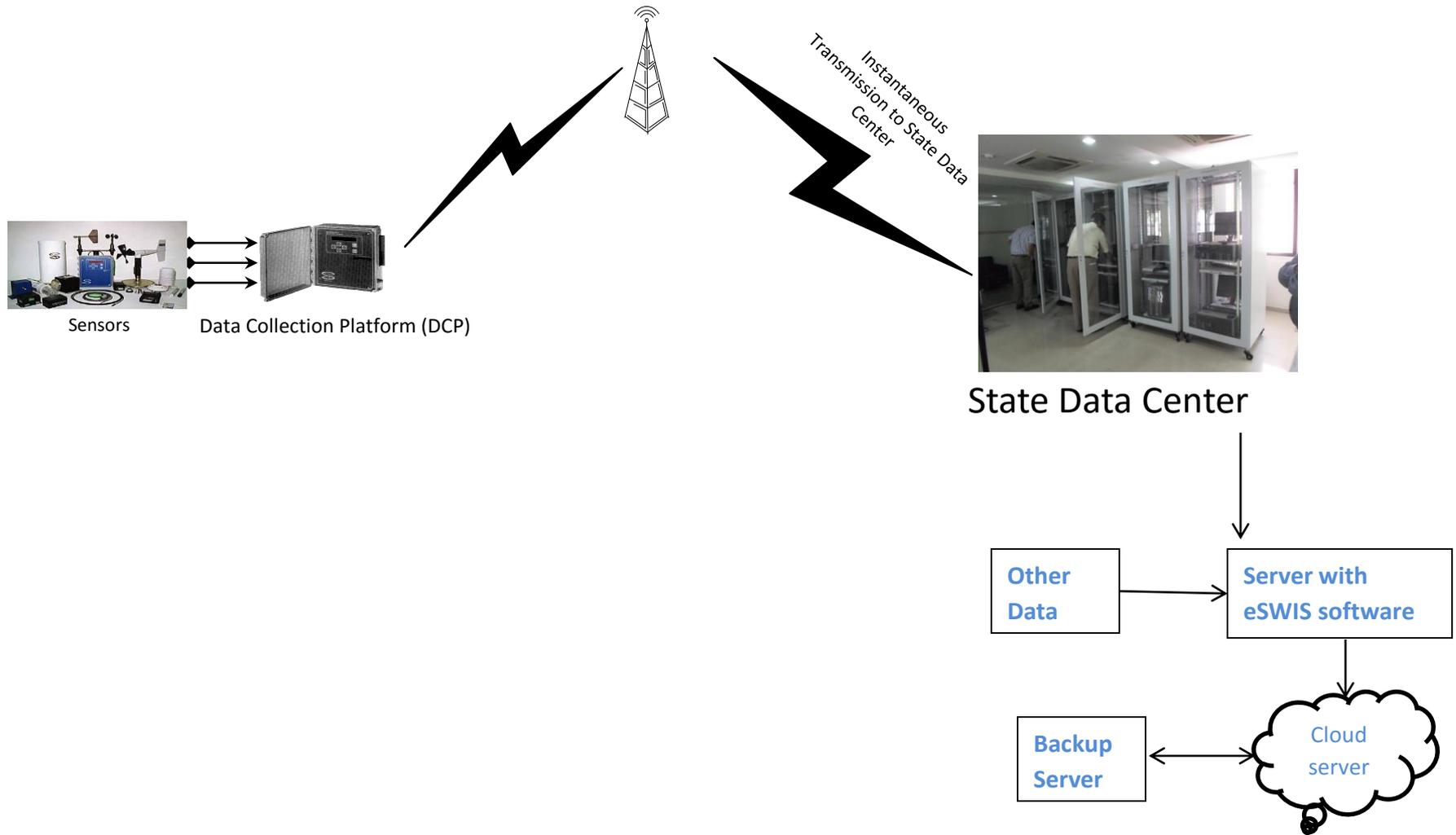




- **Data flow using INSAT**



- **Data flow using VSAT**



- **Data flow using GSM**

Advantages of using Centralized telemetry and software

Saving to State:

Set up cost

Earth Receiving Station = INR 1 Crore (CWC has three back up)

Software (eSWIS) = INR 1 crore

Operation cost = 20 lakh per year (10% of system)

In 10 years it would save almost = $2 + 0.20 * 10 =$ INR 4 crore for a state

- Automatic backup system with three ERS at CWC, would save data loss.
- In case of INSAT, first landing point for station data would be CWC ERS at Delhi
- In case of GSM/VSAT, the data would first land on server of State Data Centre



A1. Implementation arrangement



Procurement of Hydromet

Civil Works: integrated or separated

CWC: Empanelling of Make/models of Hydromet instrument, Geophysics and sondes

State IAs: Financial bid for installation and commissioning will be done by IAs

Agencies who are ready with the Hydromet bid, may proceed without waiting for Framework agreement.

Institutional Arrangement

- Installations would be supervised by CWPRS
- Post Installation, Inspection and Acceptance would be supported by CWPRS experts
- Quality Checks on Data would be integral part of Software
- CWC would validate data for the installed stations
- CWC would also ensure Database format and structure including uniform metadata for stations



A2. National and State data centers



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- All Data Centers Proposed (National, River Basin, State, Regional, District) must initiate the procurement process in the 1st Year of the Project
- All State Data Centers must be equipped with video conferencing systems



A2: Water Data Acquisition System



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MoWR:

TAMC: Technical support and quality control: Provide regional Hydromet experts for day to day guidance.

CWC:

- Centralized Framework Agreement for RT Hydromet DAS (Framework agreement would shortlist the makes and models of sensors, and states will bid for financial quotation only), till it is finalized States are advised to prepare full bid document.
- Arrangements for telecommunication: INSAT/VSAT
- Upgrade eSWIS for RTDAS (INSAT, GSM, VSAT)
- Arrangements on real time dataflow with the states

CGWB: Introduce Centralized software for RTDAS for DWLR

NIH: Develop Hydromet Training program

CWPRS: R&D

States: Prepare bid documents of RTDAS for Package 1.



B: Water Resources Information System



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B1. Web-based Water
Resources Information
System

B2. Water Resources
Information products



B1. Web-based Water Resources Information System



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National Hydrology Project

Database system for entry, storage, validation and visualization

Surface Water:
E-SWIS
(data entry, storage and dissemination)

Groundwater
E-GEMS
(groundwater estimation and management system)

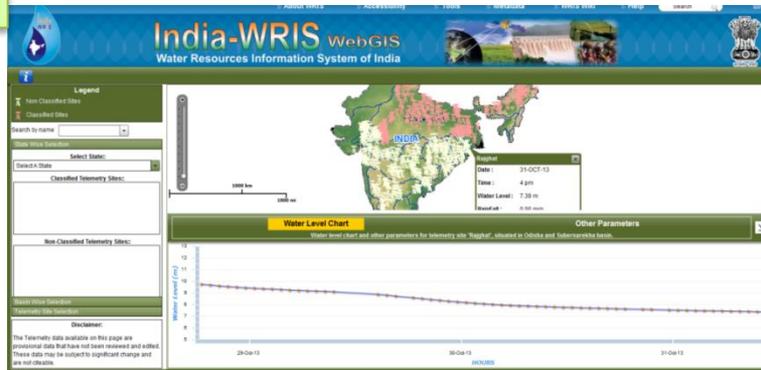
Water Quality
GIS based Water Quality Portal

National Web-based Platform for data dissemination to wider stakeholders

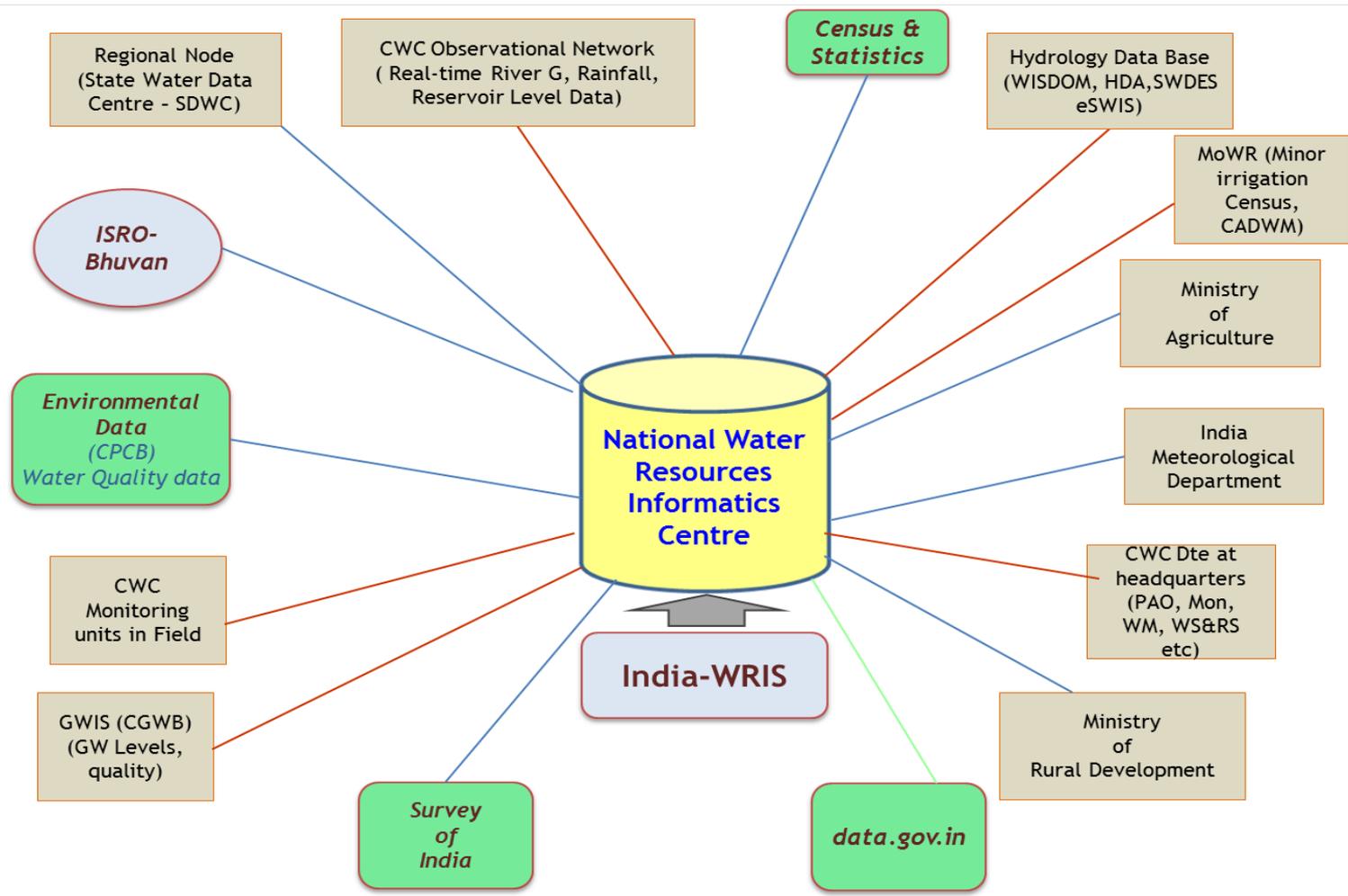
(MoWR: IndiaWRIS)
Web-based sharing of non-classified data
<http://www.india-wris.nrsc.gov.in>



State WRIS

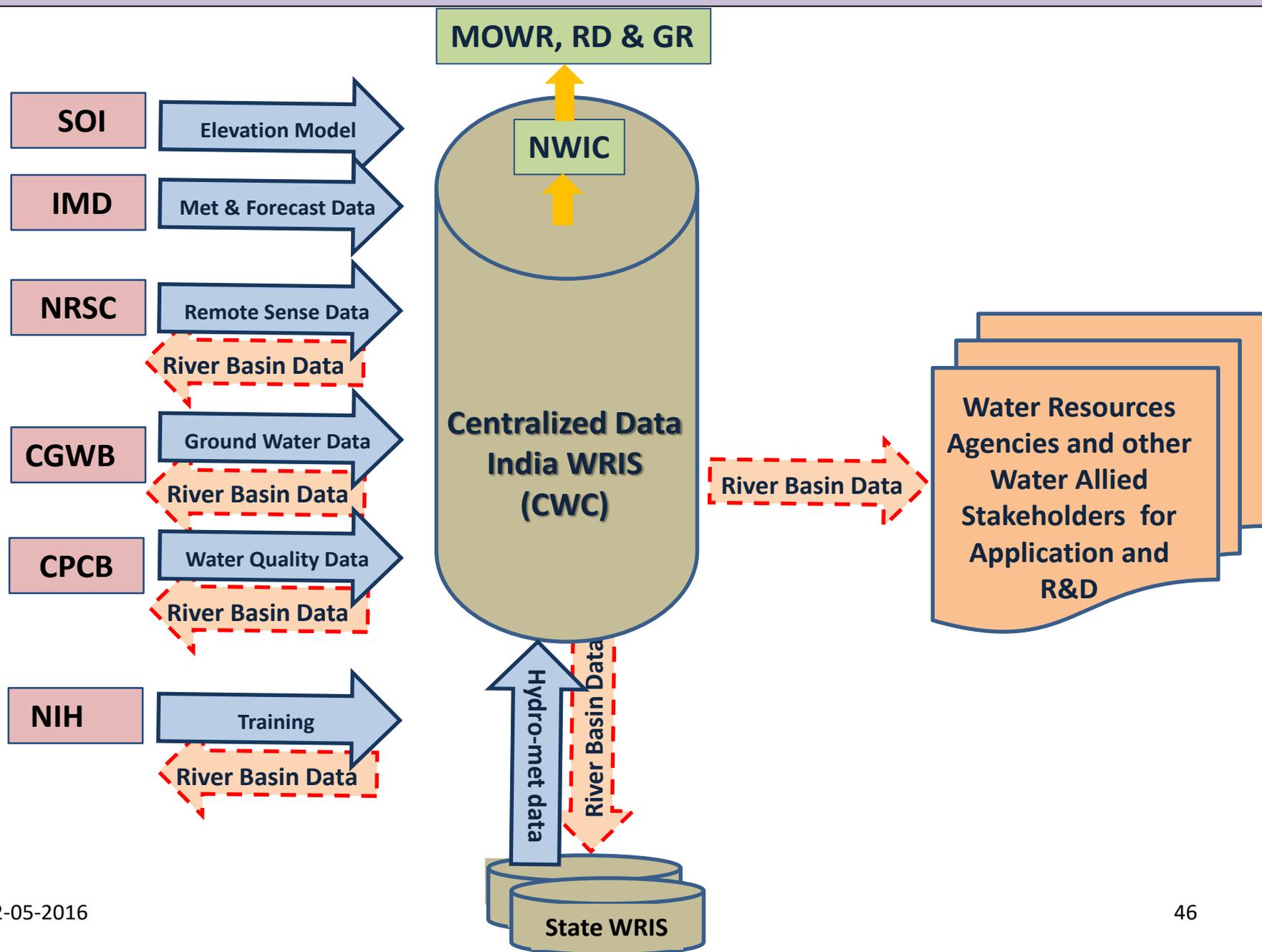


India-WRIS/NWIC



- **Creation of State Nodes of India-WRIS**
- **Development of Web Services**
- **Support for creation of State-WRIS**
- **Linkages of various models/outputs**

NWRIS





B1.2 State Water Resources Information System

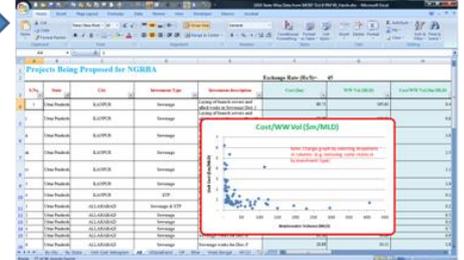
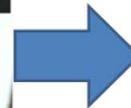


Development of State-WRIS

The states should follow the IndiaWRIS standards for integration,

The purpose of State-WRIS is to “serve” and exchange with other stake holders such as Drinking, Agriculture and watershed department.

Digitization of Water related data





B1: How to implement?

- National Water information center will administer India-WRIS
- State water resources information will exchange the data with India-WRIS and will customize for their own need : MOU?
- They will have access to all the layers at IndiaWRIS while they can add their own.

Procurements:

- States, Servers/Softwares (if wish to have separate)
- IndiaWRIS: Upgrade to accommodate state chapters (contact NRSC to replicate Bhuvan). Please start with a state or two right now.



B1. How to implement State WRIS

- Some states already have with different division/agencies
 - TN: SWARMA (WRD)
 - AP: Planning department
 - MH: MERI?
- Natural partner could be state remote sensing center for spatial information generation/integration



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B2. Knowledge products

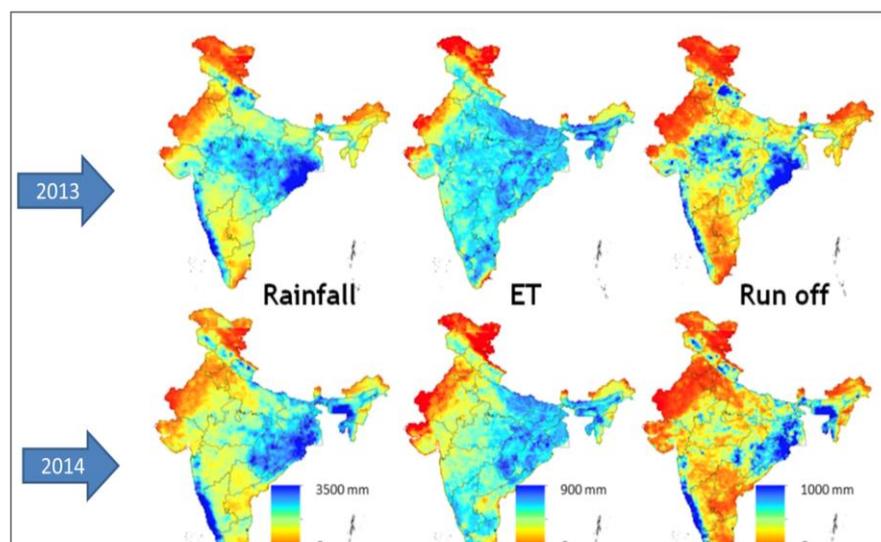
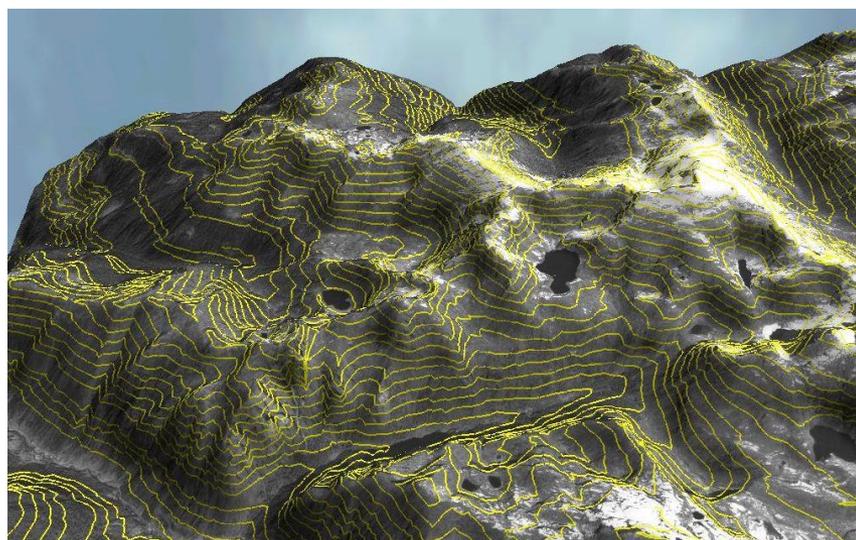
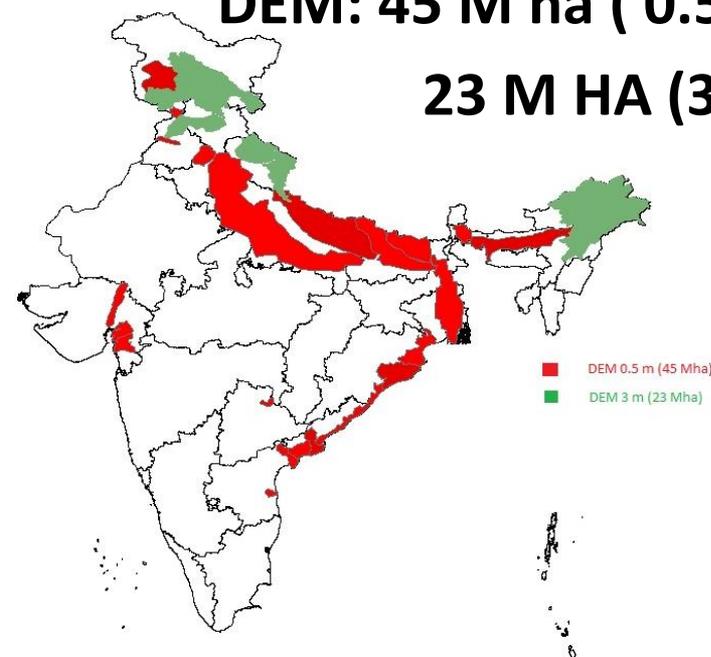


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- Centralized Procurement of High Resolution DEM
- Centralized procurement of RS products: real time ET
- Centralized arrangement for weather forecast

DEM: 45 M ha (0.5m)

23 M HA (3 m)



B2: High Resolution Digital Elevation

High resolution may be categorized into different resolutions:

Entire India:

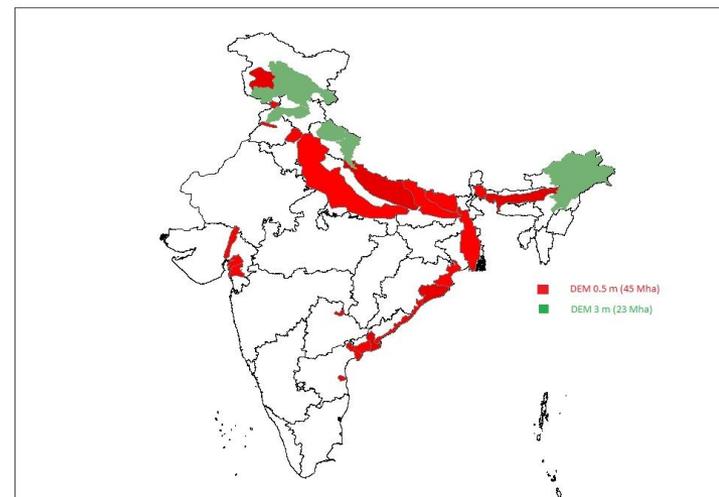
- Existing IndiaWRIS is available for 20m
- Will aim to improve to 5-10 m using existing information or remote sensing based information.

Focus area

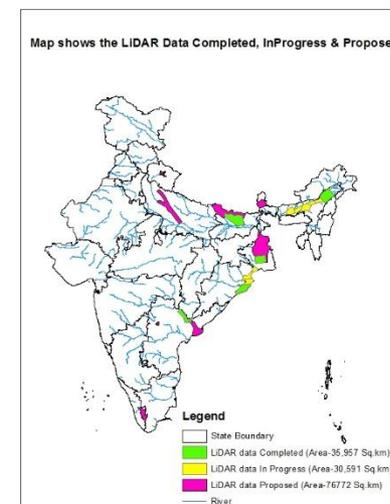
- 0.5 m for 45 m ha
- 3 m for 23 M ha

Although major purpose of high resolution is flood, there are other uses as well for minor irrigation, PMKSY, watershed projects etc.

- Integration of existing information NRSC and other agencies (State remote sensing centres may be given this task)
- Asses the potential of High resolution remote sensing



Proposed for very high resolution



NRSC



B: Water Resources Information System



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National Products in WRIS/SWRIS

- Access to spatial information including more than 80 layers of IndiaWRIS
- Real time hydromet and reservoir level data.
- High Resolution elevation map for India ranging from (0.5 to 3m)
- Weather forecast (1, 3,5, 7 days and seasonal)
- Macro Water Resources assessment: Rainfall, ET, Runoff estimate
- Remote sensing based estimates for India: Snowmelt, real time ET, land use, irrigation benchmarking,
- Flood forecasting at major stations by CWC

State Knowledge Products would be required to customize for stakeholders such as Agricultural department, drinking water: e.g. Drought (looking for water availability, existing water resources options?); PMKSY: rainfed areas, irrigation options (SW/GW) considering water availability across the basin



B: Water Resources Information System Action plan



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MoWR:

- MoU for integration of data/information among central and state agencies.
- Accessibility system among central and state agencies.
- Linkages among Central agencies for accessibility.

CWC:

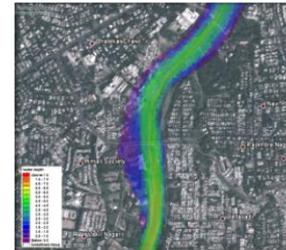
- Upgrade E-SWIS to monitor irrigation water use, for RTDAS, mobile based manual recording.
- Provide e-SWIS state admin control to states and training.
- Consult with states for Priority of DEM
- Standardization of data structure for IndiaWRIS so that states can also use same: introduce the state chapters asap
- States to decide about server/software facilities for statesWRIS

CGWB: Make e-GEMS operational and accessible to all NHP agencies.

CWC: Develop training program and procurement of prelim pages

State D... of DEM

C1. River basin
modelling



C2. Streamflow
forecasting and
reservoir operation



C3. Irrigation design
and operation



C4. Purpose Driven
Studies



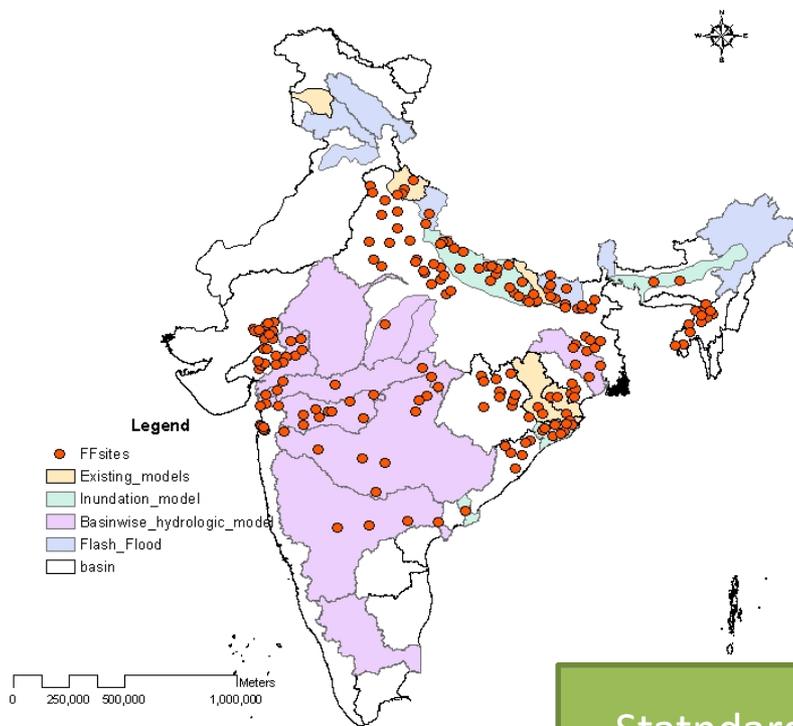
C1. River basin modelling



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- Rive Basin Planning for all 20 basins will be carried out under NHP.
 - Basin level model incorporating both surface water & ground water will be developed by CWC in collaboration with CGWB and state agencies.
 - CWC to develop framework/ model for assessing surface hydrology, water allocation and water infrastructures **(CWC will engage Consultant)**
 - CGWB will develop framework/model for groundwater assessment of the basin. **(CGWB will engage Consultant)**
 - CWC & CGWB will jointly develop the SW-GW interaction framework.
 - CWC to develop platform for scenario analysis and data visualization (user interface for hydrological model and data management)
 - Committee for choosing BASINWISE model (surface; ground and WQ) is to be established.
 - State to depute State Engineers in development of Macro Model to CWC
 - Using the same approach and models, States will develop their own-sub basin (micro) model for all 20 sub-basins. **(State will engage separate consultant)**
- CWC NHP Budget*
 - Development of macro model of the basin
 - State NHP Fund*
 - Development of sub-basin level models for all 20 river basins in India

Streamflow forecast is for flood, planning and management of river flows/reservoirs



CWC will lead streamflow forecast linked with climate for FF stations particularly for main stem

States downscale the model/upscale the model for their sub-basins

States setup for reservoir operation system

Standard model to be used: HEC suite

Procurement:

- CWC will engage a consultancy for streamflow forecasting for entire India
- States will engage consultancy for sub-basins (not covered by CWC) and reservoir operation systems

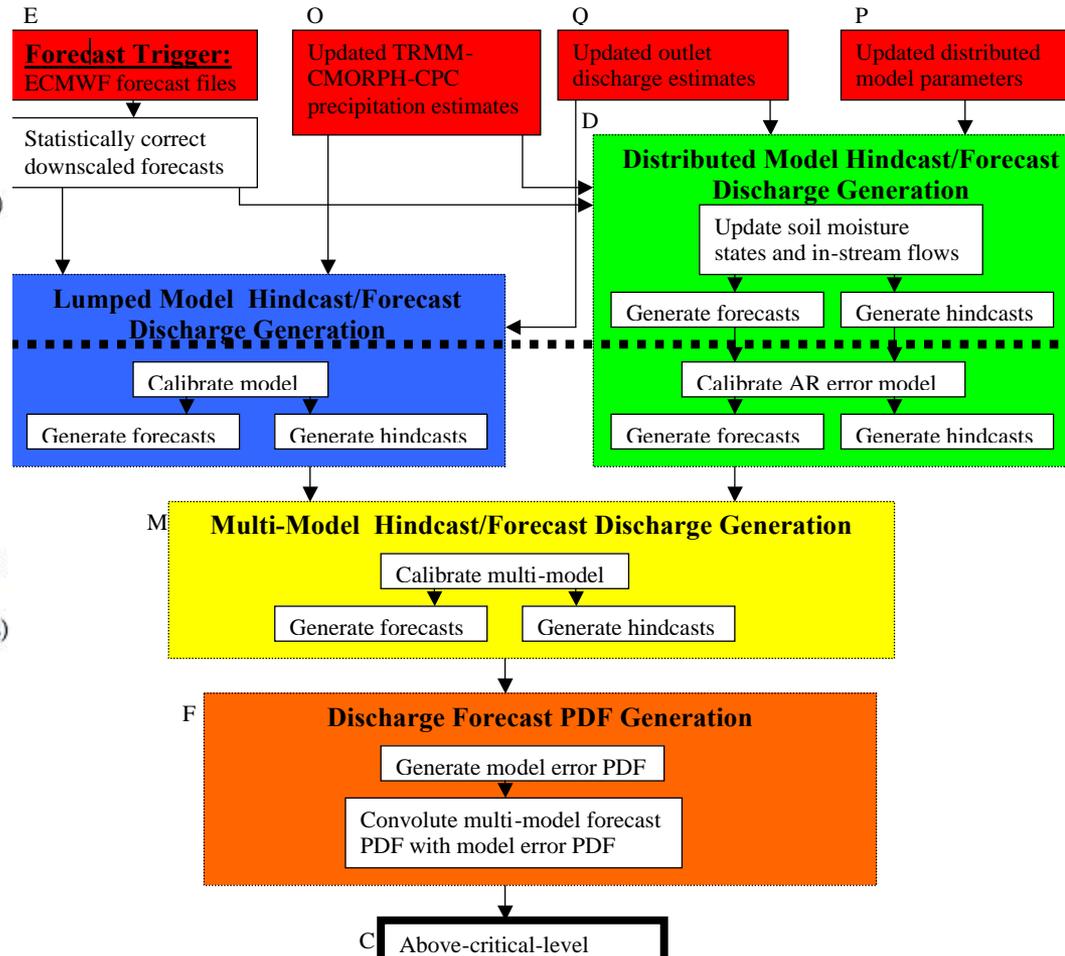
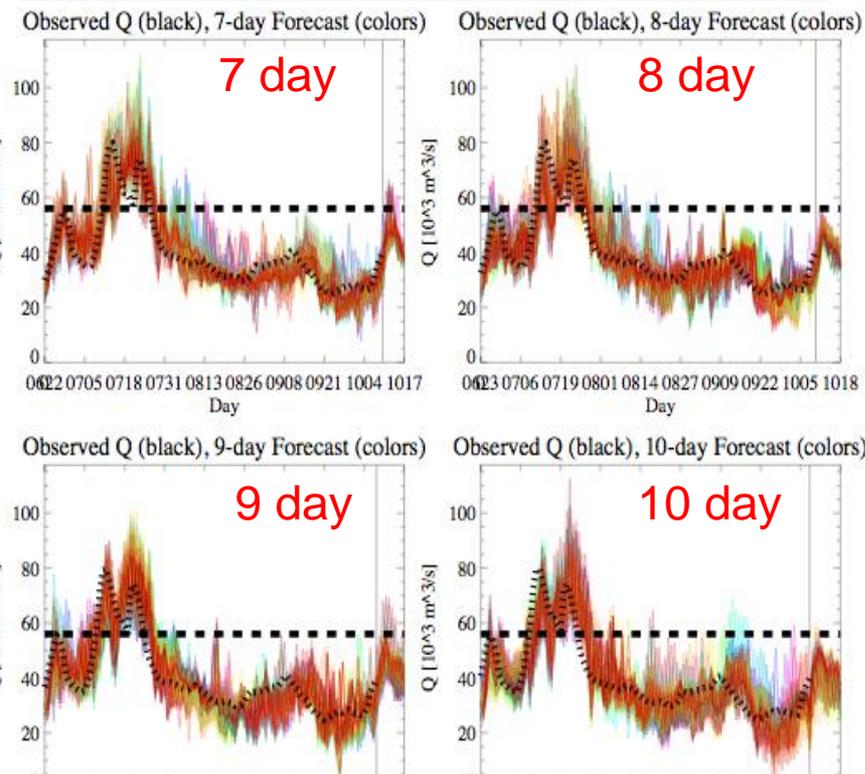
C2. Ensemble SF ROS



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Ensemble forecast in Brahmaputra in collaboration with NCAR

Brahmaputra Discharge Forecast Ensembles



Procurement:

- CWC will engage a consultancy for ensemble based streamflow forecast

B. River basin tools

Basin name	CWC				
	Flood Modelling	DSS for IWRM	Regional Water Availability Model	Sediment Transport Modelling	Aquatic Life Assessment
Area of North Ladakha not draining into Indus Basin					
Barak and others Basin				Yes	
Brahmani and Baitarni Basin			Yes		
Brahmaputra Basin	Yes		Yes		Yes
Cauvery Basin	Yes		Yes		
East flowing rivers between Godavari and Krishna Basin			Yes		
East flowing rivers between Krishna and Pennar Basin			Yes		
East flowing rivers between Mahanadi and Godavari Basin			Yes		
East flowing rivers between Pennar and Cauvery Basin			Yes		
East flowing rivers South of Cauvery Basin			Yes		
Ganga Basin	Yes	Yes		Yes	
Godavari Basin	Yes	Yes			Yes
Indus (Up to border) Basin	Yes		Yes		Yes
Krishna Basin	Yes		Yes		
Mahanadi Basin	Yes	Yes	Yes	Yes	
Mahi Basin	Yes		Yes		
Minor rivers draining into Bangladesh Basin					
Minor rivers draining into Myanmar Basin					
Narmada Basin	Yes		Yes		Yes
Pennar Basin	Yes	Yes	Yes		
Sabarmati Basin					
Subernarekha Basin	Yes	Yes	Yes		
Tapi Basin	Yes	Yes		Yes	
West flowing rivers of Kutch and Saurashtra including Luni Basin					Yes
West flowing rivers South of Tapi Basin					Yes



C1,2. Implementation arrangements



- CWC will engage major consultancy for both flood forecasting, ensemble weather forecast sedimentation and WR assessment (??).
- States will simultaneously develop similar systems for tributaries with the help of regional Institutes or consultancies. NIH shall depute modelers to each state and will also guide.
- During development, States representative should be deputed with CWC. CWC will setup River Basin centers during operation such as:
 - Krishna- Godavari Basin; Hyderabad
 - Ganga: Patna, Lucknow
 - NE center: Guwahati

Engage consultancy and decide the models so that both State and central could integrate their models.



C: Water Resources Operation and Application



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MoWR:

CWC: TORs are prepared for major 4 consultancies, initiate the bidding.

CGWB: Prepare TOR for major procurements.

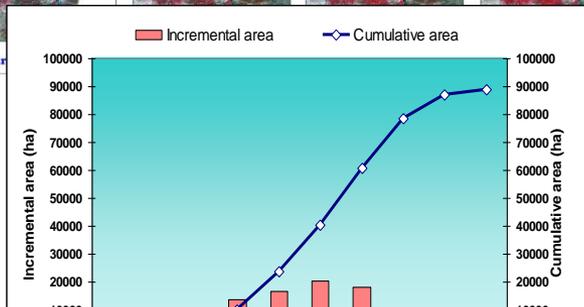
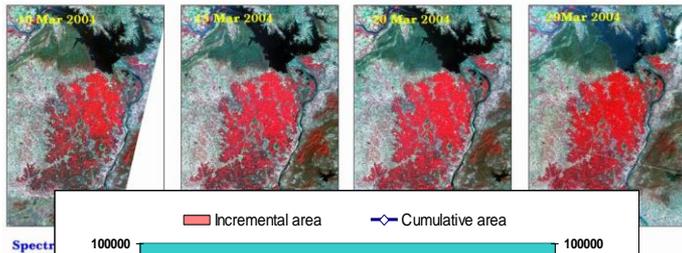
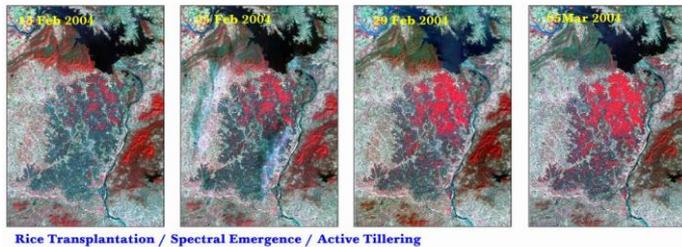
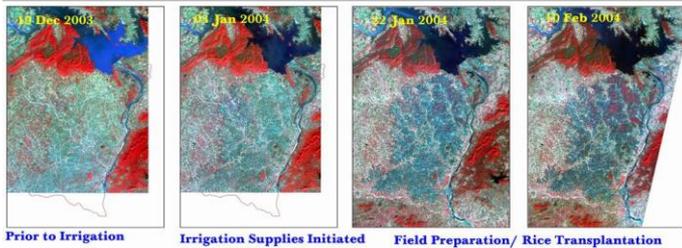
NRSC: Develop TOR/action plan for major procurements.

NIH: Continue the Guidance to the states in PDS.

States/ RBO: Prepare TOR for consultancy based on the CWC ToRs

C3: Irrigation design and Operation

DSS for Irrigation distribution and Water Management



Objectives

- ❖ To develop Decision Support System for irrigation water distribution and management
- ❖ To enhance irrigation water use efficiency

Deliverables

- ✚ Cropping pattern and crop progress
- ✚ Crop condition
- ✚ In-season irrigation water demand
- ✚ Optimal irrigation schedule

NRSC has set up a methodology, Need state volunteers to select the systems

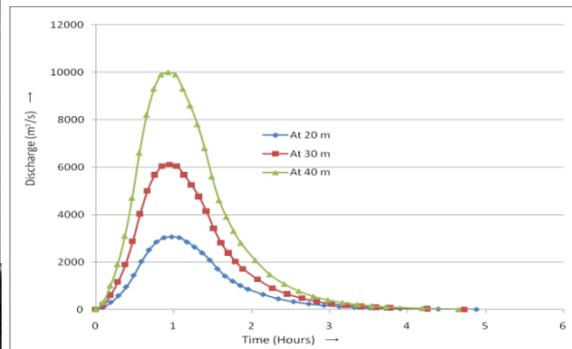
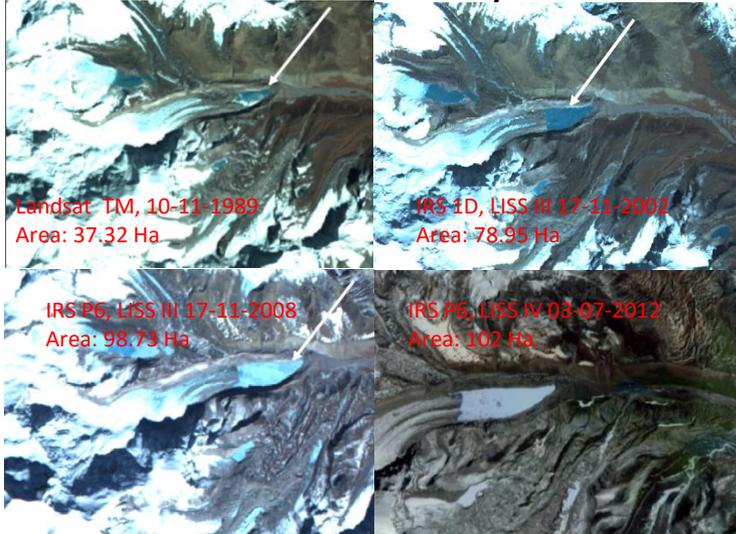
C4: Purpose Driven Studies

Glacial Lakes Risk Assessment and Glacial Lake Outburst Flood (GLOF)

Simulations for Priority GL (Ten)

South Lhonak Glacier lake, Sikkim

Growth of the lake as viewed by RS Satellites



hydrographs (for different depths of lake)
in case of sudden burst of the lake

Objectives

- ❖ Glacial Lakes Risk Assessment and Prioritization in Indian Himalayan river basins
- ❖ GLOF Risk Simulations for Priority Glacial Lakes

Highlights

- ❖ Depth of inundation varies from 3 to 8 m when the discharge is 10,000 m³/s
- ❖ Outburst of the lake alone may not cause any flood problem in the area.

Deliverables

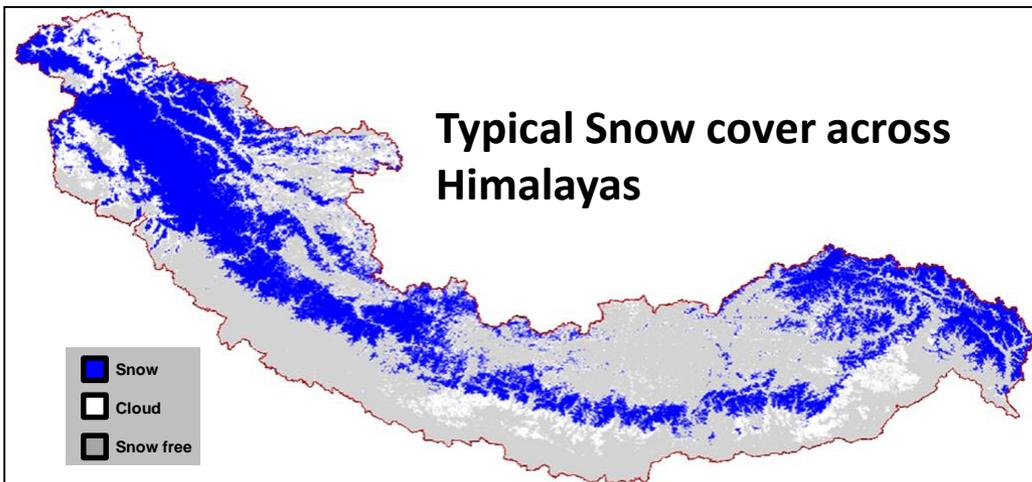
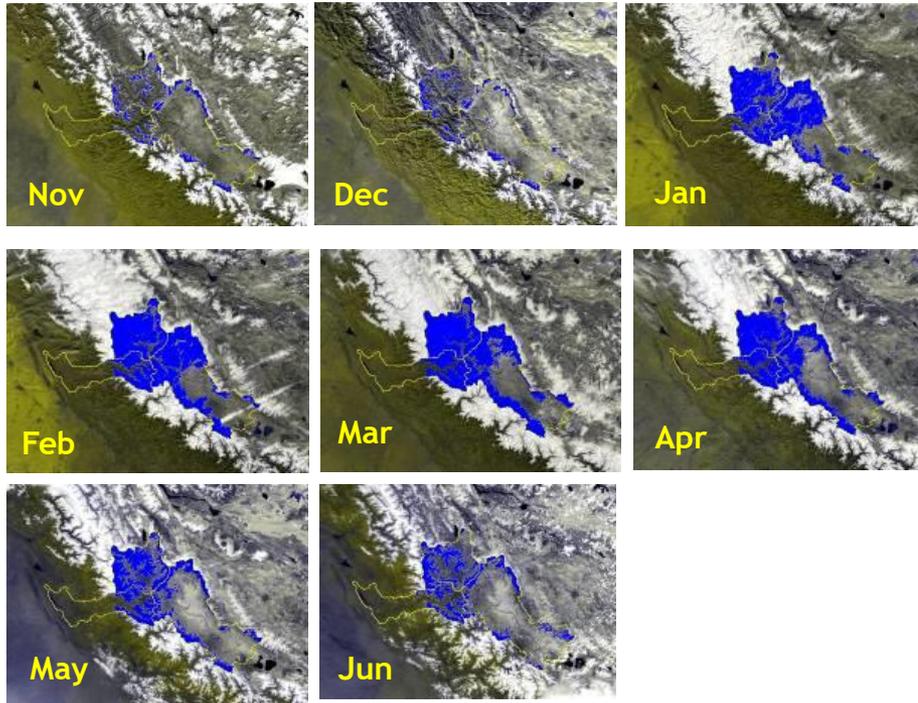
- + Ranking of Glacial of lakes wrt GLOF risk
- + Simulation of GLOF risk for selected Hazardous GL&WB's

Possible flood inundation simulation in case of
Sudden failure of the earthen dam (at 10000 m³/s)



C4 PDS: Estimation of snow melt runoff in Himalayas

Seasonal Snow cover changes in Sutlej basin



Objectives

- ❖ To develop methodology for estimation of snow melt using energy balance approach
- ❖ To generate a spatial product indicating expected snow melt at each pixel for Himalayas

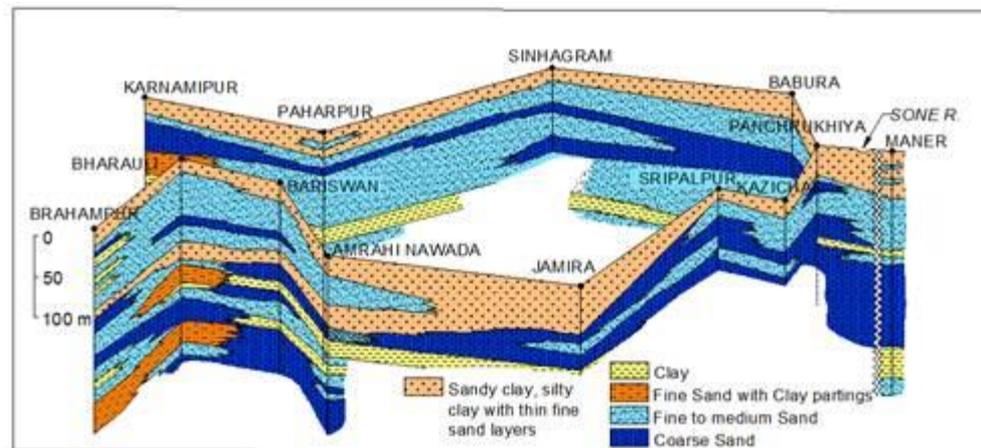
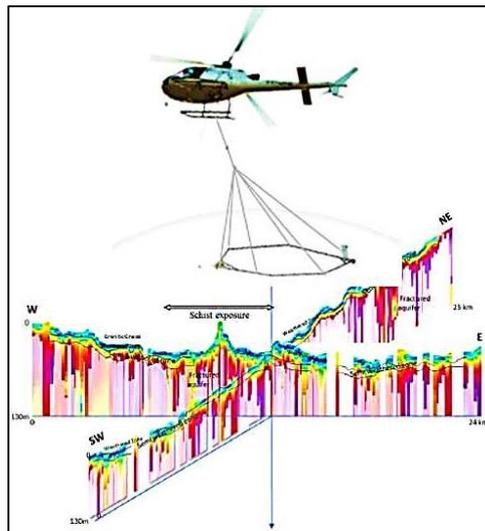
Deliverables

- + Generation of spatial snowmelt product for Himalayas (1-2 day)
- + Snowmelt Runoff at selected river basin outlets
- + Inflow into Reservoirs



C4: PDS: Groundwater Management

- Support National Aquifer Mapping program through innovative systems
- Study Surface-groundwater interaction
- Community based groundwater monitoring and management



Decision Support System (DSS) for ground water development, management and artificial recharge



C4. Purpose Driven Studies



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Specialized studies – R & D component

Some key topics includes:

- **Dam Break Analysis**
- **Salinity intrusion in costal aquifers**
- **Cloud burst**
- **Glacier Lake Outburst Flood (GLOF)**
- **Reservoir Sedimentation**
- **Water Quality Studies**
- **Irrigation system benchmarking**
- **Effectiveness of groundwater recharging**
- **Impacts of checkdams on flow regime of rivers/ rivulets**

- **NIH will central coordinate with all IAs for the implementation of PDS**
- **Collaboration with reputed national and international research/ academic institutes**



D: Institutional Capacity Enhancement

D1. Water Resources
Knowledge Centre

D2. Professional
Development

D3. Project
Management and
Technical Assistance

D4: Operating
expenses



D1. Water Resources Knowledge Centre



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River basin modelling centers (Selective river basins to pilot):

- Krishna
- Mahanadi
- Damodar
- ??



Groundwater modelling center (Selective region/issue):

- Hardrock – AP/Telangana
- Alluvial ??



Centre of Excellent for Water Management

- North East Centre of Excellent for Water – Guwahati
- ??

Facilitate knowledge exchange:

- With internationally reputed Institutes
- States may consider reforming WALMIs/IMTI



D2. Professional Development



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Training

- Training need assessment of state water agencies
- Customized training
- National level training
- International training
- Web-based training courses

Study tours (International/ National) for cross learning

Involvement of local universities for capacity building (identifying at least 2 local universities per state and building their capacity to act as TOT)

Development of Master Degree course in Water Resources/ Flood Management in collaboration with IITs.

Development of Centre of Excellence for R&D

Collaboration with international institutions (UNESCO-IHE, UNESCO WATER etc)



D2. Professional Development



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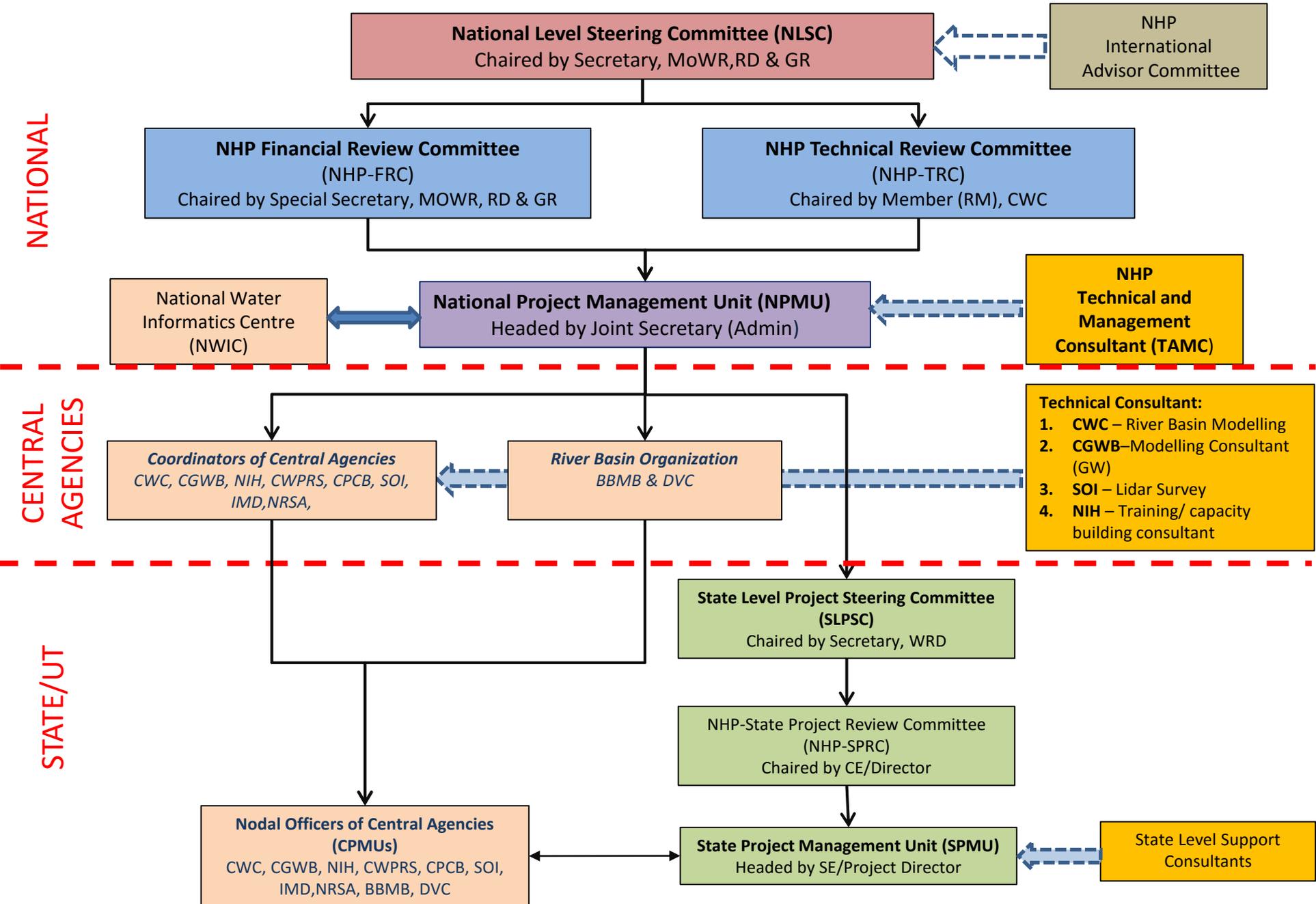
Capacity building

- NIH will conduct generic water management courses on annual basis in collaboration with CWC, CWPRS, IMD, NRSC, CGWB. Annual Training calendar will be prepared at the start of each financial year.
- States with design customized training program based on their needs and issues.
- National/ international tours will be conducted for cross-learning
- Collaboration will be done with reputed academic institutions (national/ international) and short and long term course will be introduced.
- NHP will support specialized degree program/certificate courses through collaboration with the local and international institutes
- Focus will also be made on development of web-based training course, e-learning, distance learning etc.

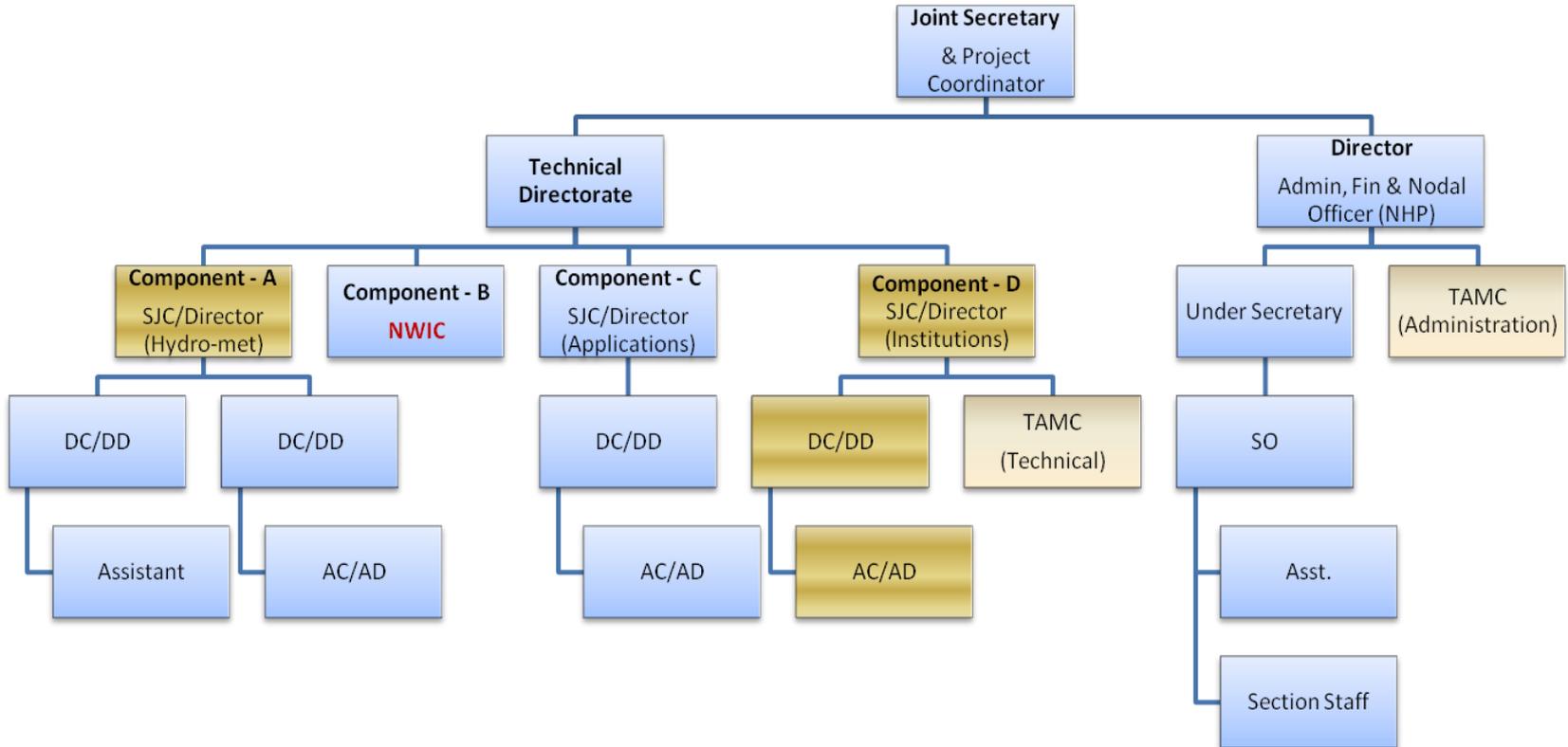
Staff Assignment

- Assign the staff who is interested in Hydrology and water management
- Continuity of staff should be ensured otherwise capacity building goes waste.

NATIONAL HYDROLOGY PROJECT (NHP) : INSTITUTIONAL IMPLEMENTATION ARRANGEMENTS

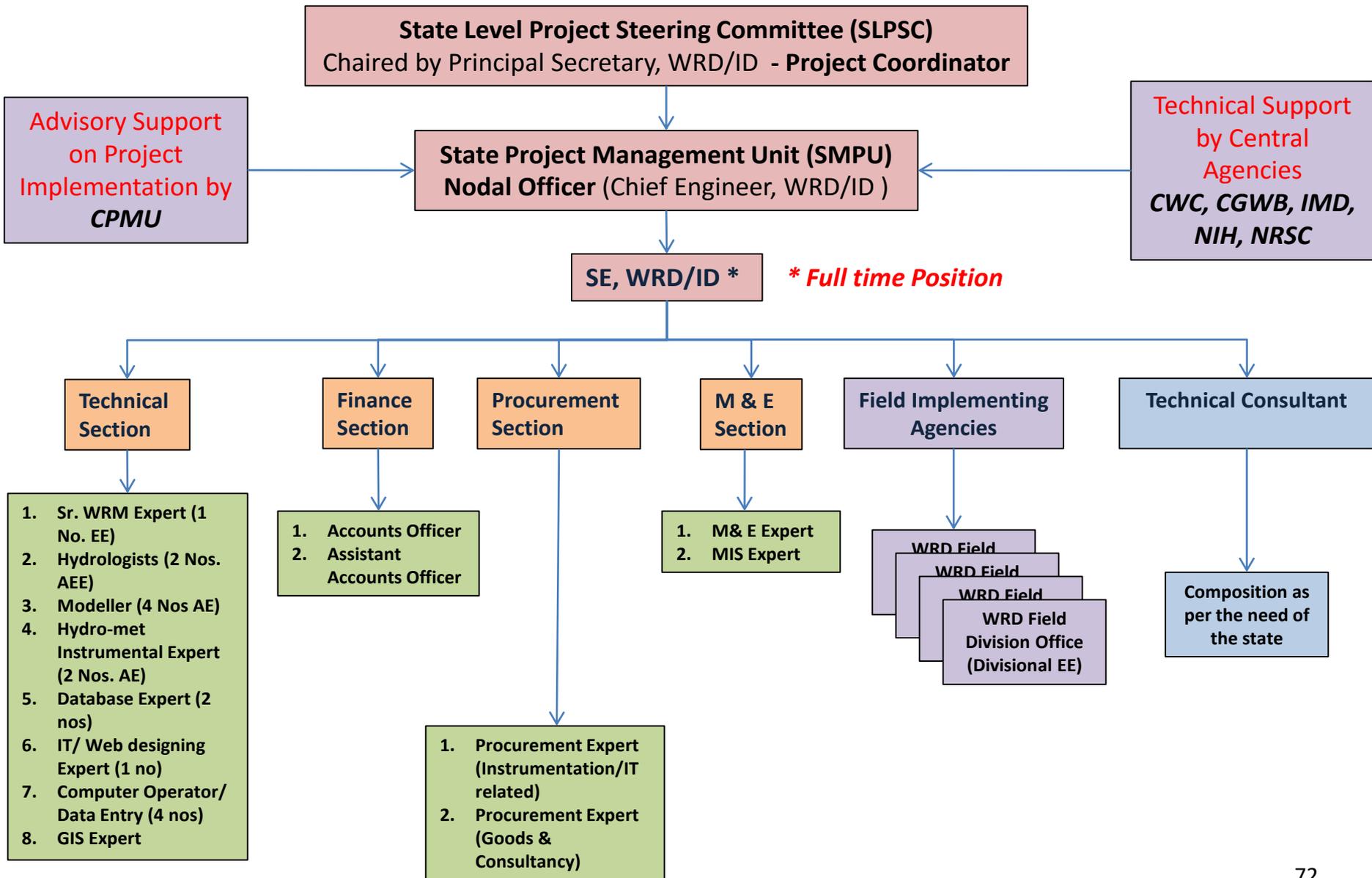


NATIONAL HYDROLOGY PROJECT (NHP) National Project Management Unit (NPMU)



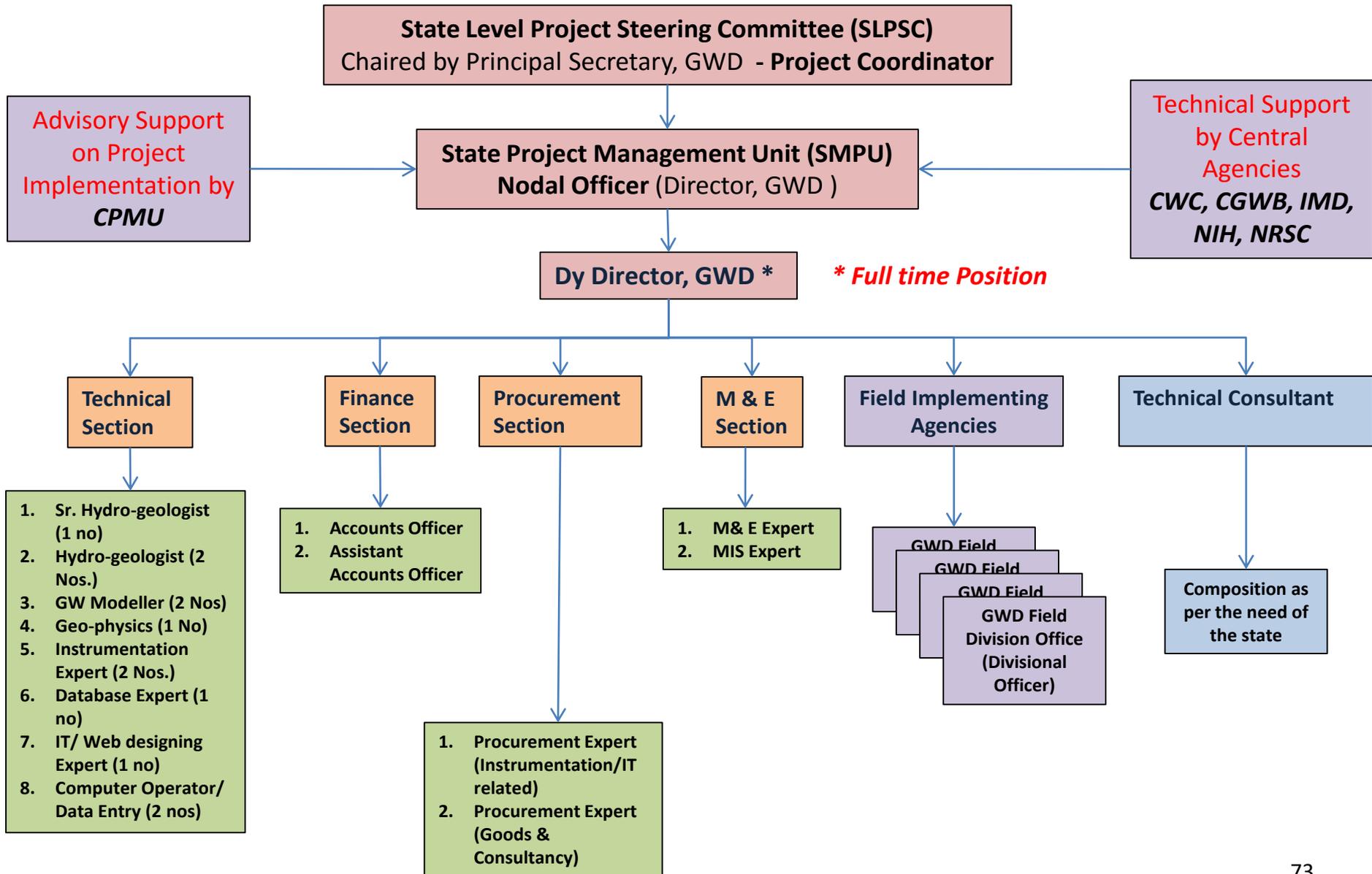
NATIONAL HYDROLOGY PROJECT (NHP)

STATE LEVEL INSTITUTIONAL IMPLEMENTATION ARRANGEMENTS (Surface Water)



NATIONAL HYDROLOGY PROJECT (NHP)

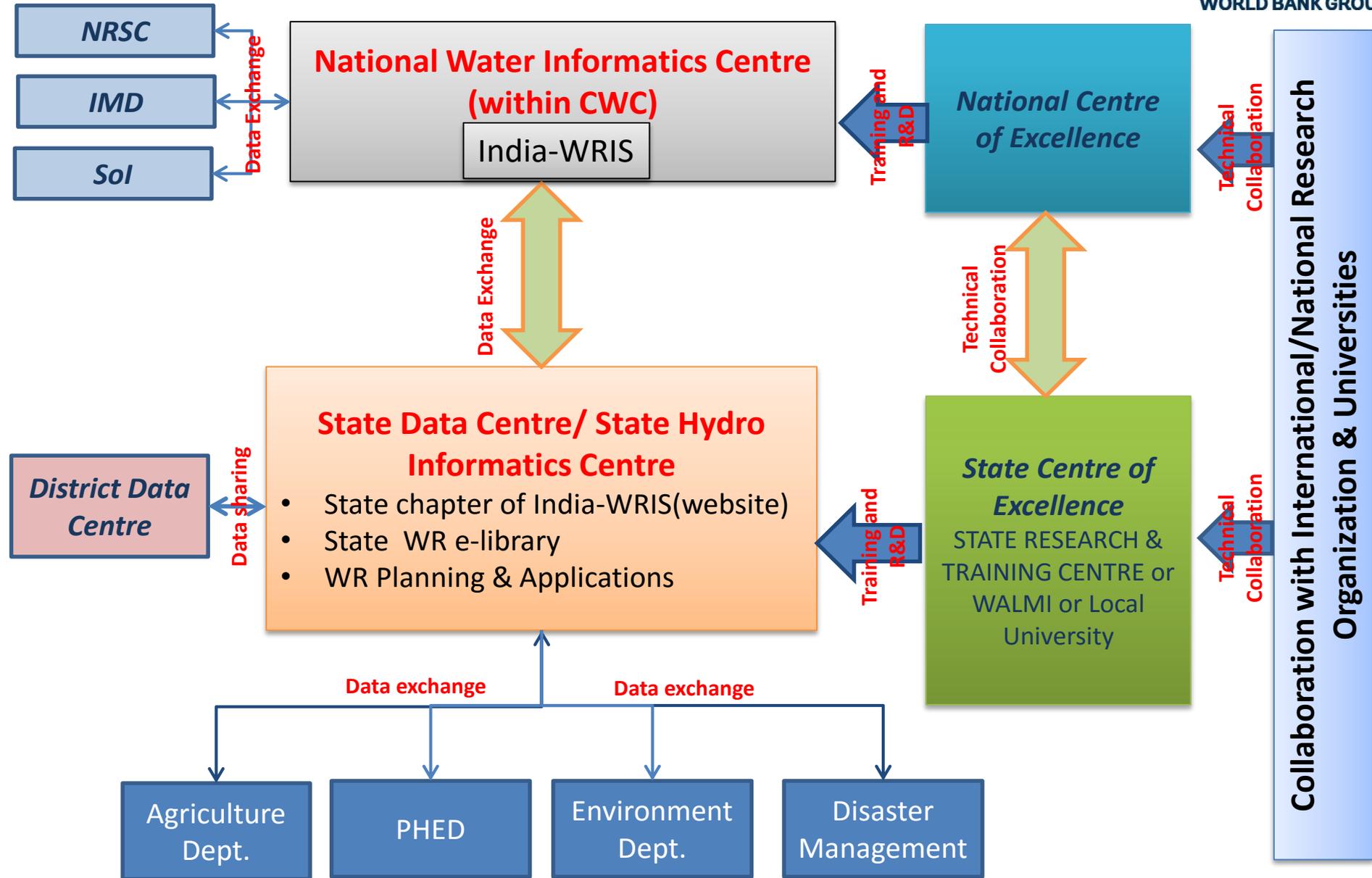
STATE LEVEL INSTITUTIONAL IMPLEMENTATION ARRANGEMENTS (Ground Water)



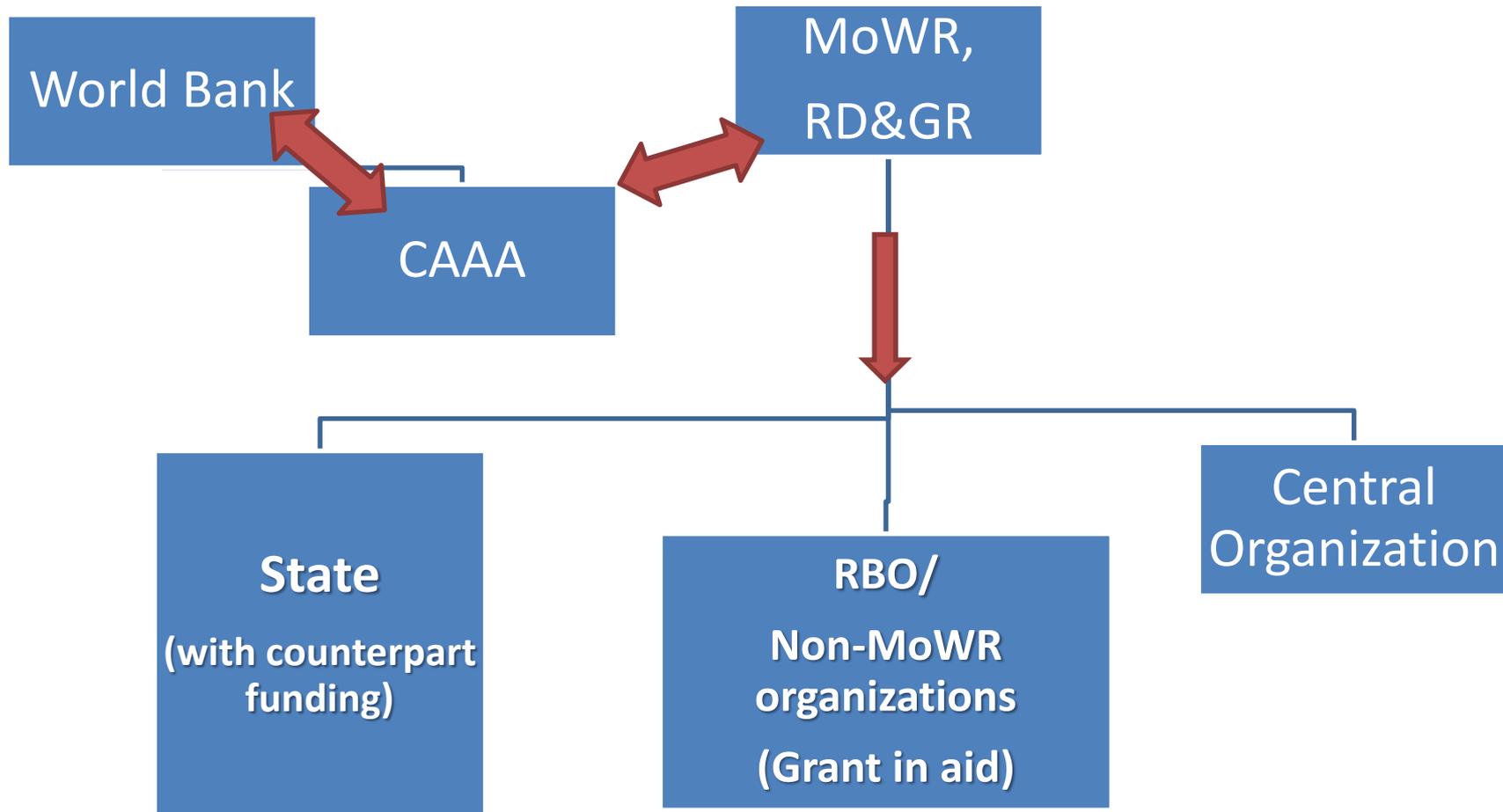
PROPOSED INSTITUTIONAL CONCEPT



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Tentative Fund flow System (MoWR to confirm)



Fund flow mechanism from MoWR to states needs to be simplified to ensure timely release of funds.

States are advised to work with MoWR to develop the procedures

Thank You